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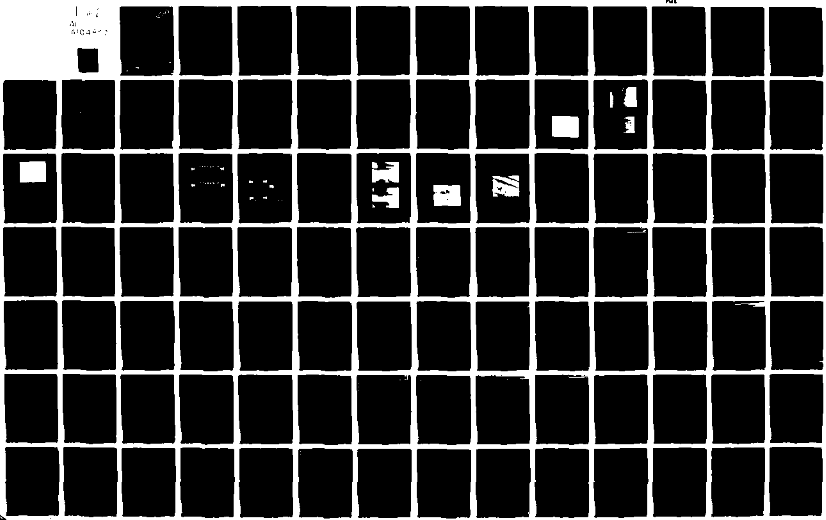

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MONOLITHIC MICROWAVE PREAMPLIFIER

FINAL REPORT

JULY 1981

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PREPARED FOR

OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA

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A GaAs monolithic microwave preamplifier has been fabricated and characterized. The design was implemented by a cascade connection of eight stages in a single ended configuration. The input, output and interstage matching sections utilized microelectronic spiral rectangular inductors and MOM capacitors.

The best unit yielded an average gain of 25 dB from 3 to 8 GHz.

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CONTENTS

1. INTRODUCTION AND SUMMARY

This report describes TRW's monolithic microwave preamplifier development performed under contract No. N00014-77-C-0645 for the Office of Naval Research. The report covers the period from 1 July 1979 to 31 December 1980; which corresponds to the third and final phase of this program.

Phases 1 and 2 covered periods 1 September 1977 to 31 March 1978 and 1 April 1978 to 30 June 1979, respectively, with corresponding Monolithic Microwave Preamplifier Technical Reports 1 and 2.

During Phase 1 of this program, TRW developed a computer model for GaAs Microwave Field Effect Transitors in order to study the noise and gain properties of such devices for different channel doping densities and geometry configurations. During Phase 2, TRW used this computer model to carry out the design of a low noise integrated preamplifier to operate at X-Band. The third and final phase of this contract encompasses the fabrication and characterization of this integrated preamplifier as well as its' active and passive components. The results of this third and final activity are the subject of the present report.

2. SIGNIFICANT CHANGES FROM ORIGINAL DESIGN

Since the issue of "Technical Report No. 2," September 1979, the monolithic microwave preamplifier was subjected to one more redesign cycle for reasons of process feasibility and compatibility existing at the time.

The major changes from the original design were:

a) Uniform doping profile of 1×10^{17} cm^{-3} for the FET devices instead of the selective doping profile of 4.0×10^{16} cm^{-3} in the channel and 5.0×10^{17} cm^{-3} under the source and drain contacts.

b) Source and drain contact lengths of 15 μm instead of 10 μm.

c) All inductor values have been modified to be less than 2.5 nH. This upper bound for inductance was found to be necessary in order to keep the electrical length of the inductor below one-quarter wavelength.

d) The 10 nH inductor on the drains of stages 3 through 8 were replaced by tank circuits for the reason specified in c).

The FET devices with this new doping density and contact length under the biasing conditions V_{DD} = 2.89 V, V_{GG} = -1.90 V, and I_d = 4.7 mA had a set of S-parameters in the frequency range of 8 to 11 GHz as predicted by TRW's FET computer model (Table 2-1).

Table 2-1. Predicted S-Parameters for FET Devices

F (GHz)	S_{11}	S_{21}	S_{12}	S_{22}
8	0.848 $\angle -70.6$	1.417 $\angle 121.4$	0.084 $\angle 53.2$	0.930 $\angle -24.0$
9	0.826 $\angle -76.9$	1.340 $\angle 116.0$	0.090 $\angle 50.3$	0.922 $\angle -26.6$
10	0.805 $\angle -82.6$	1.267 $\angle 111.0$	0.095 $\angle 47.8$	0.915 $\angle -29.0$
11	0.787 $\angle -87.9$	1.199 $\angle 106.4$	0.100 $\angle 45.6$	0.909 $\angle -31.5$

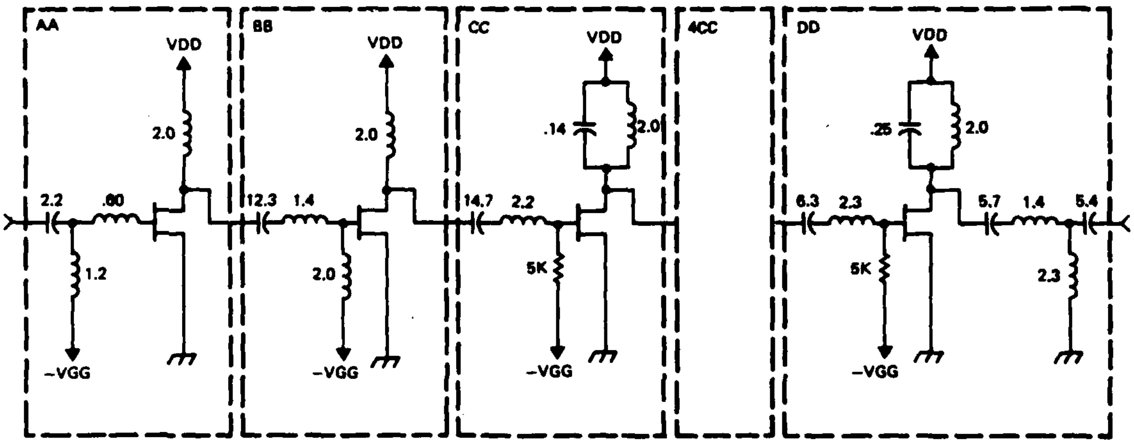
The noise figure, optimum source reflection coefficient for minimum noise, and the noise resistance of the FET devices were predicted as shown in Table 2-2.

Table 2-2. Predicted Noise Parameters for FET Devices

F (GHz)	NF (dB)	Γ_s opt	$R_n (\Omega)$
8	3.02	$0.706 \angle 33.4$	12.0
9	3.28	$0.681 \angle 37.4$	12.0
10	3.53	$0.658 \angle 41.4$	12.0
11	3.76	$0.637 \angle 45.3$	12.0

With these scattering and noise parameters, the preamplifier was redesigned and computer-optimized; the resulting schematic is shown in Figure 2-1 with the preamplifier's predicted performance (Table 2-3).

X BAND PREAMPLIFIER



NOTES:

ALL RESISTOR VALUES ARE IN OHMS
ALL INDUCTOR VALUES ARE IN NANOHENRIES
ALL CAPACITOR VALUES ARE IN PICOFARADS
ALL FET DEVICES

GATE LENGTH = 1 μm
DEVICE WIDTH = 380 μm
GATE-SOURCE SEPARATION = 1 μm
GATE-DRAIN SEPARATION = 1 μm
SOURCE CONTACT LENGTH = 15 μm
DRAIN CONTACT LENGTH = 15 μm
DOPING UNDER CONTACTS = 1×10^{17} cm^{-3}
CHANNEL DOPING DENSITY = 1×10^{17} cm^{-3}
CHANNEL DEPTH = 0.20 μm

Figure 2-1. Preamplifier Schematic Diagram

Table 2-3. Preamplifier's Predicted Performance

F (GHz)	Gain (dB)	Noise Figure (dB)
8	28.4	5.6
9	28.4	5.5
10	31.2	5.6
11	29.2	5.7

The comparison of actual and predicted performances and the analysis of discrepancies will be covered in Sections 5 and 6, respectively.

3. PROCESS DEVELOPMENTS

The processing of monolithic microwave integrated circuits using GaAs materials and device technology is the primary objective of this program. During the early part of this program, work was aimed at refining and standardizing the process technology. Those aspects of the technology considered to be of particular importance to optimize microwave analog integrated circuit performance were identified and addressed. An attempt has been made to define a standard process for GaAs analog IC fabrication; this is a difficult task due to the rapid evolution of technology. The optimized process sequence which was used to fabricate the microwave IC preamplifier is shown in Figure 3-1, and major processing steps illustrated in Figure 3-2.

3.1 MATERIAL PREPARATION

The fabrication of GaAs integrated circuits using a mesa isolation process has been achieved using three approaches:

- Epitaxial technology
- Ion-implantation into epitaxially grown, undoped buffer layers on semi-insulating substrates
- Ion-implantation into semi-insulating substrates.

The first approach is a direct extension of early techniques used to fabricate high performance discrete GaAs devices. The second technique has been used to offset the poor quality of early semi-insulating substrates. With recent improvements in substrate materials development and characterization, the third approach is emerging as the most desirable method for fabricating high density circuits with small device geometries. Secondary ion mass spectroscopy (SIMS) has been a key element in the development of improved substrate materials and in the understanding of the empirical procedures used to select acceptable crystals for the direct ion-implantation approach.

STEP NO.	OPERATION
1.	CRYSTAL QUALIFICATION
2.	CLEAN WAFERS
3.	SILICON IMPLANTATION - 3×10^{12} cm^{-2}, 100 keV
4.	CAP AND ANNEAL – SiO_2/Si_3N_4, 850°C, 30 MINUTES
5.	STRIP CAP AND CLEAN WAFERS
6.	PHOTORESIST
7.	MESA ISOLATION MASK
8.	MESA ETCH
9.	CHECK ISOLATION
10.	STRIP PHOTORESIST AND CLEAN WAFERS
11.	PHOTORESIST
12.	OHMIC CONTACT MASK
13.	CLEAN WAFERS
14.	DEPOSIT OHMIC METALS – AuGeNiAu
15.	METAL LIFTOFF
16.	ALLOY CONTACTS
17.	TEST PROBE FET – I_s AND V_s AT 9 POINTS
18.	CLEAN WAFERS
19.	DEPOSIT SILOX
20.	PHOTORESIST
21.	FET GATE AND FIRST LEVEL INTERCONNECT MASK
22.	ETCH SILOX
23.	DEPOSIT GATE METALS – CrPtAuPt
24.	METAL LIFTOFF
25.	SINTER GATE METALS
26.	STRIP SILOX AND CLEAN WAFERS
27.	TEST PROBE FET – I_{DSS} AND V_p AT 9 POINTS
28.	DEPOSIT SILOX
29.	PHOTORESIST
30.	VIA MASK
31.	ETCH VIAS
32.	STRIP PHOTORESIST AND CLEAN WAFERS
33.	DEPOSIT BOND METALS – TiAl
34.	PHOTORESIST
35.	INTERCONNECT AND BOND PAD MASK
36.	ETCH METALS
37.	ALLOY METALS
38.	TEST PROBE FET AND RESISTOR BAR – I_{DSS}, V_P, G_m, R_{SH} AND R_C AT 9 POINTS

Figure 3-1. Standard GaAs Microwave Integrated Circuit Process Sequence

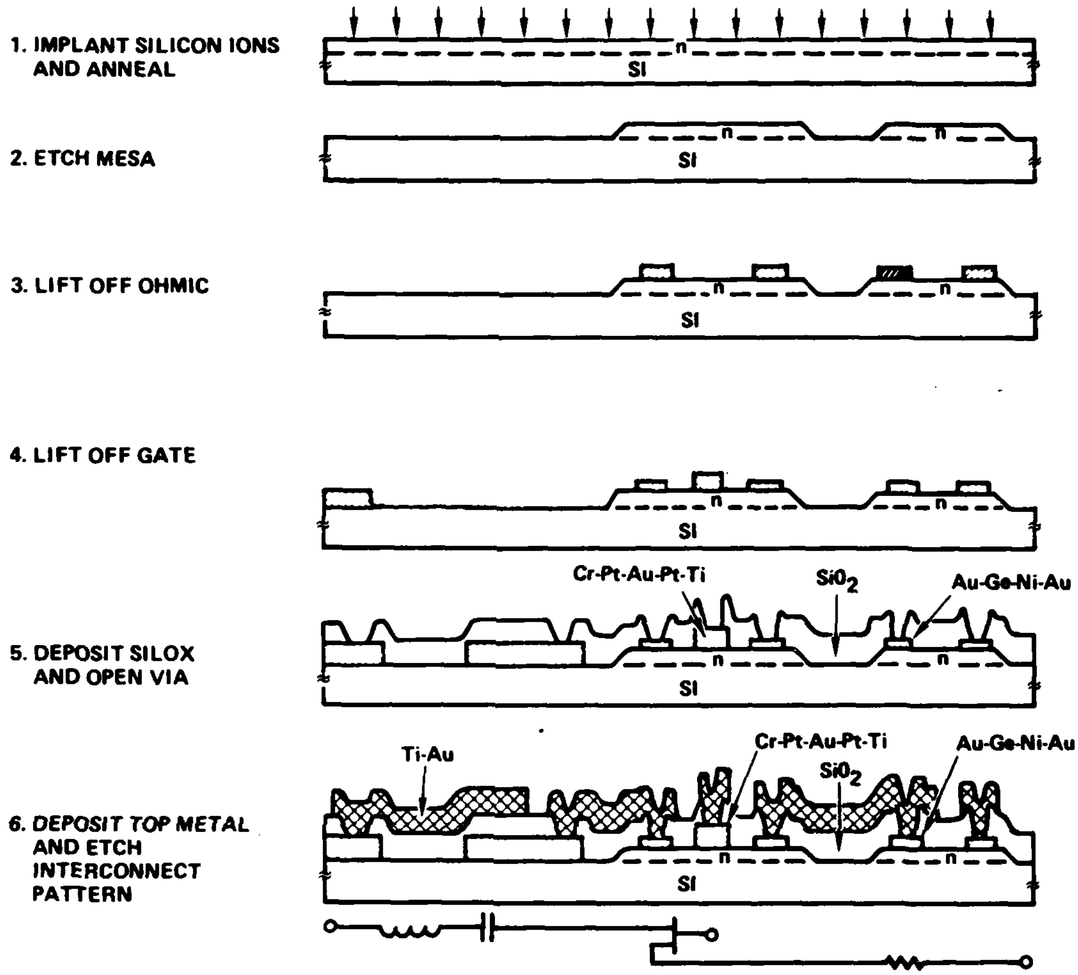


Figure 3-2. GaAs Standard Mesa Process

3.1.1 Substrate Qualification

The standard qualification procedure for a crystal shown in Figure 3-3 uses wafers from both ends of the crystal ingot for thermal conversion and standard implantation tests. For the thermal conversion tests, the samples are coated with a Si_3N_4/SiO_2 cap and annealed at 850°C for 30 minutes in N_2. After stripping the films, capacitance-voltage measurements are made on aluminum Schottky diodes formed on the wafer to determine if the material converts from semi-insulating to conducting. It has been TRW's experience that material which does not pass this first test will give irreproducible ion-implanted profiles. Additional samples are ion-implanted with Si+ ions at an energy and dose similar to the one being used for device

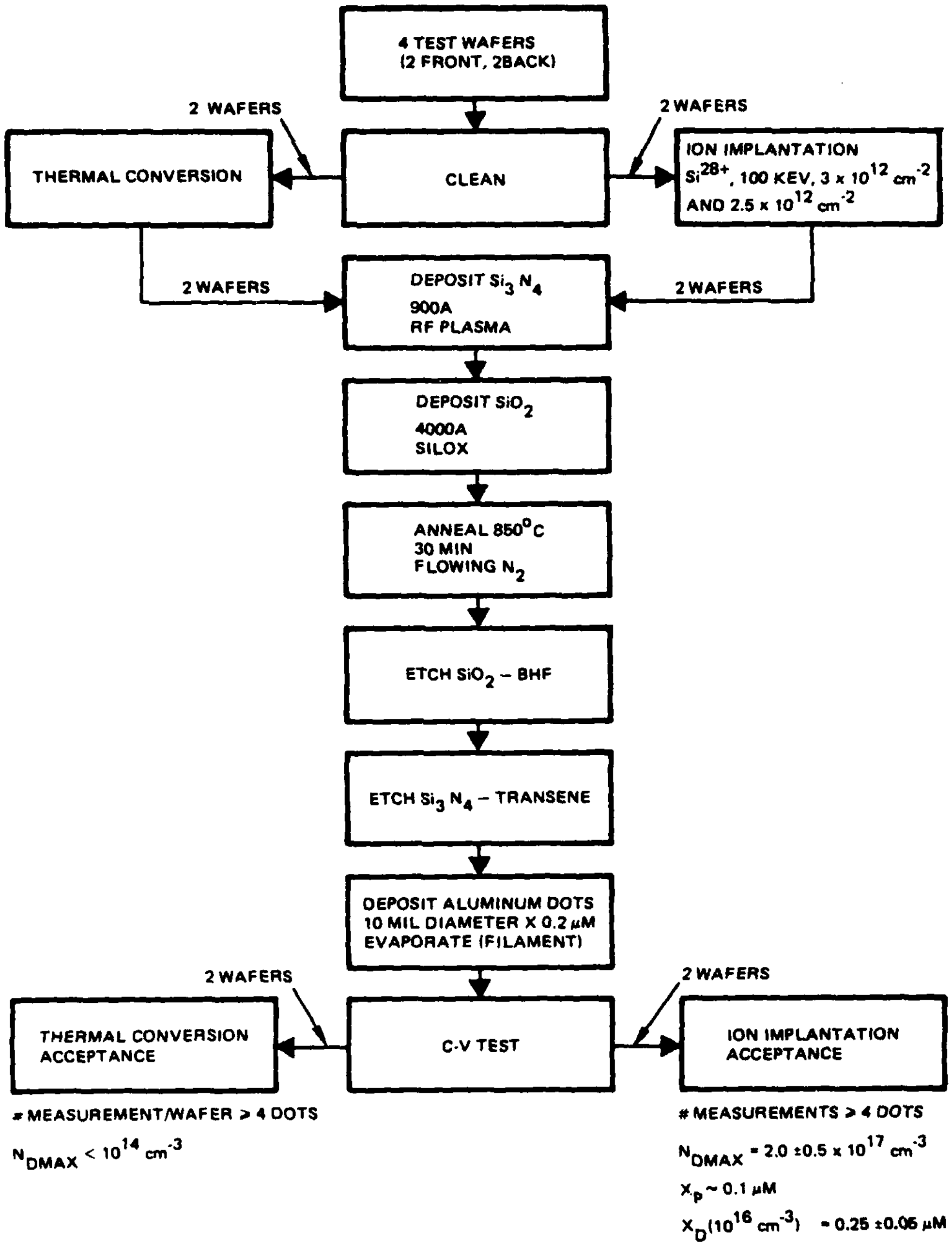


Figure 3-3. GaAs Crystal Qualification Procedure

fabrication (typically 100 keV and 3×10^{12} cm^{-2}). The samples are capped, annealed, and stripped, and C-V measurements are conducted again. Careful inspection of the resulting dopant profiles determines if the material will produce sharp profiles or profiles with deep "tails" which are inadequate for device fabrication. Figure 3-4 compares an acceptable profile versus nonacceptable profiles.

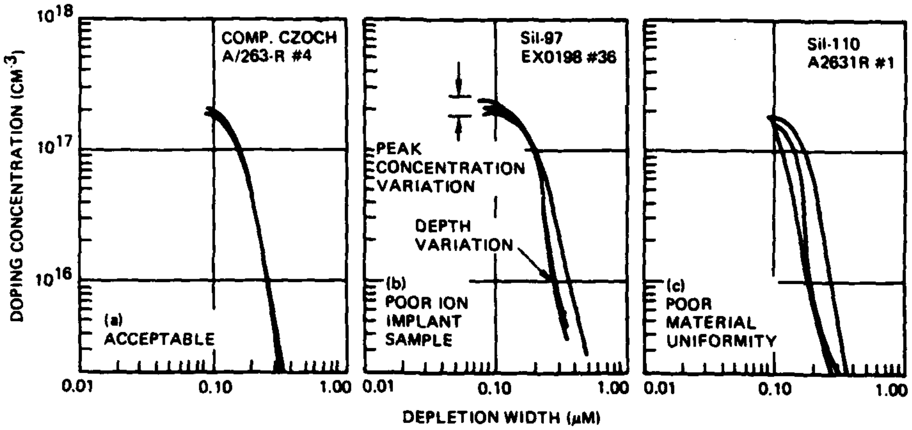


Figure 3-4. Concentration Profiles for Silicon-Implanted GaAs Substrates

SIMS measurements have been conducted on as-received wafers, wafers following the thermal conversion test, and wafers following the silicon implantation test. The SIMS studies were conducted by TRW and Charles Evans and Associates. These studies have clarified the reasons for the wide variability of Cr-doped semi-insulating material. The material variability is related to the variability of background donors (typically silicon) ranging from 10^{15} to 10^{17} cm^{-3} and the redistribution of chromium during thermal annealing. During thermal cycling, chromium atoms are found to pile up at the surface (10^{19} cm^{-3}, 50 to 100 Å) and to deplete just below the surface, (100 to 1500 Å). If the depleted chromium concentration falls below the background doping concentration, thermal conversion is observed. Variations in the tail region of ion-implanted profiles result from the interaction with the background donors and the profile of the redistributed chromium atoms.

Figure 3-5 shows an example of the SIMS evaluation of a thermally-annealed, unimplanted Cr-doped GaAs substrate. The background silicon doping

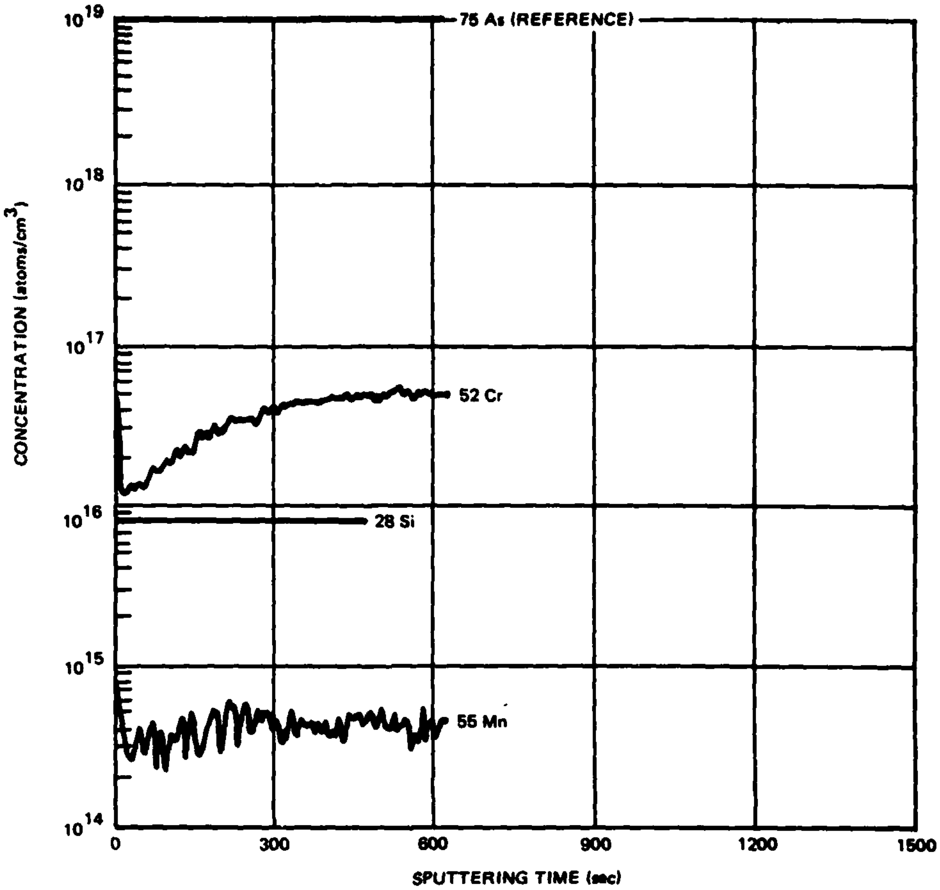


Figure 3-5. SIMS Impurity Profiles for Unimplanted, Cr-Doped GaAs Substrates

is seen to be 5 x 10^{15} cm^{-3}. The bulk chromium concentration was high enough to prevent surface conversion under heat treatment. The profile of a typical silicon implantation (peak concentration of 1.5 to 2 x 10^{17} cm^{-3}) into this wafer will be significantly disturbed as the implanted concentration falls below 5 x 10^{16} cm^{-3}.

The results of the SIMS study suggest that the best Cr-doped substrates come from ingots with a low background donor concentration (1 x 10^{15} cm^{-3}) and a low chromium doping concentration (5 x 10^{15} cm^{-3}). This hypothesis is supported in part by the improved uniformity and reproducibility observed for ion-implanted LEC wafers which contain no intentional chromium doping.

Most wafers processed for this program were Cr-doped horizontal Bridgeman-grown material obtained from Crystal Specialties. Sample wafers

from seven different suppliers were evaluated; complete ingots were purchased only when the corresponding wafers passed the standard qualification tests, unacceptable samples generally failed the thermal conversion tests following our 850°C annealing treatment.

3.1.2 Ion-Implantation

The active layer for FET's and resistors in integrated circuits is formed by ion-implantation. The pinchoff voltage, device current, and semiconductor resistivity depend on the implanted dose, range, and profile as well as the activation efficiency. The uniformity of the concentration profile of the implanted donors depends on the implanted species, the substrate quality, and the annealing techniques used to remove the implantation damage. TRW has selected Si+ as the implanted species, since it can be implanted into substrates at room temperature with good activation and minimal redistribution with heat treatment.

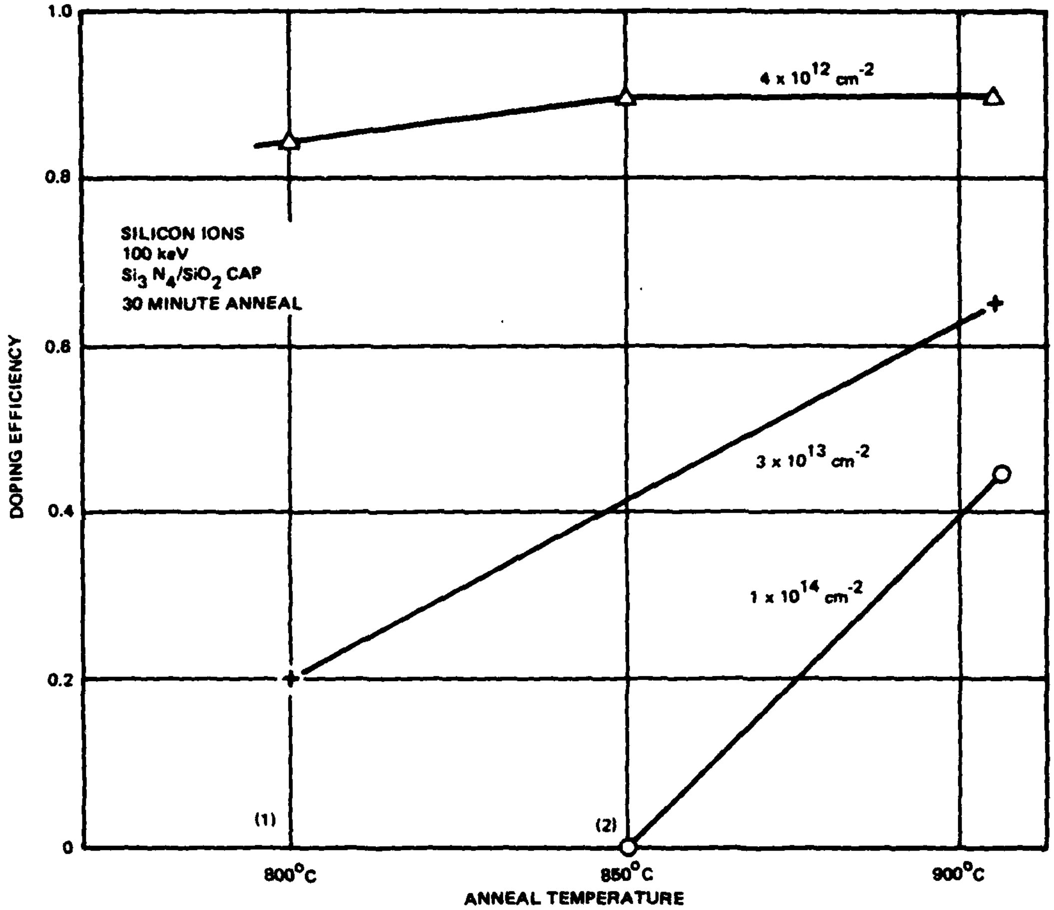
The annealing technique in the standard process uses 900 Å of plasma-deposited Si_3N_4 covered with 4000 Å of SiO_2. This annealing cap has provided high doping efficiencies and has been used with temperatures up to 900°. The standard annealing conditions for N-Channel implantation are 850° for 30 minutes. For highly doped N+ contact implants, 900°C annealing temperature is used to achieve high activation. Figure 3-6 shows the variations of the doping efficiency versus implantation dose and annealing temperature for Si+ ions at 100 keV, Si_3N_4/SiO_2 cap, and 30 minute annealing time.

3.1.3 Characterization

N-D Profile

After ion-implantation, capping, and annealing, each wafer is subject to C-V measurements to determine the doping profile; aluminum is E-beam deposited through a metal mask to form a Schottky barrier diode. A typical doping profile obtained by C-V measurements on an aluminum Schottky diode is shown in Figure 3-7. In the capacitance-voltage measurement of a Schottky diode, the concentration is expressed as

$$N = \frac{C^3}{A\varepsilon\varepsilon_0 q} \times \frac{dV}{dC}$$



(1), (2): RESIDUAL IMPLANTATION DAMAGE PREVENTS ACCURATE DETERMINATION OF ACTIVATION

Figure 3-6. Doping Efficiency for Silicon Ion-Implantation

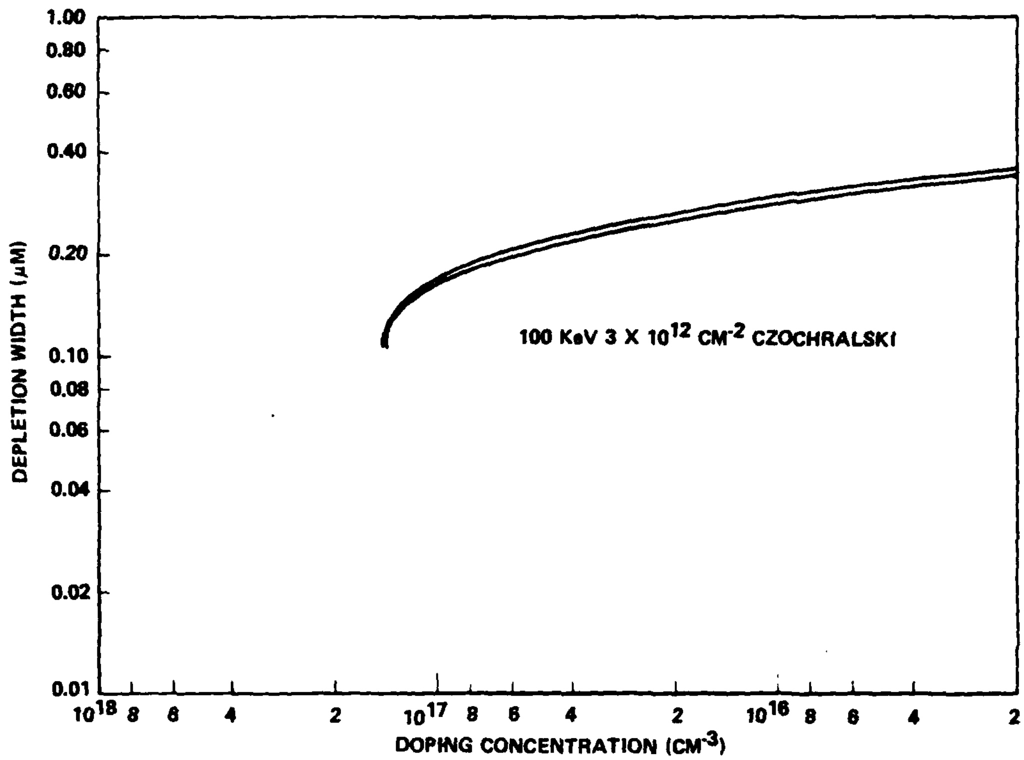


Figure 3-7. Capacitance-Voltage Profile for Ion-Implantation into Liquid Encapsulated Czochralski Grown Substrate

Where the capacitance C is the average of two differential capacitance measurements, ε is the dielectric constant, ε_0 is the permittivity of free space, q is the electronic charge, and A is the diode area. The variation of diode capacitance with applied voltage is used to determine the electrical thickness of the implanted layer. The depletion width is expressed as

$$W = \frac{\varepsilon\varepsilon_0 A}{C}$$

The C-V data is computed and plotted automatically on a profiler.

Mobility Measurements

The N-D profile obtained by C-V techniques can be verified by mobility and concentration measurements. The mobility and doping profile is measured by a combination of the Van der Pawe method and etch back technique. The Hall sample is fabricated by mesa etch followed by ohmic contact metal liftoff

and sintering. The resistivity is then measured by the Hall effect technique; a layer of anodic oxide is grown and the thickness is determined by ellipsometer. This oxide is then removed in a $HCl:H_2O$ (1:1) solution. The active layer removed is empirically determined to be 2/3 of the oxide thickness. Resistivity is measured again. By repeating this resistivity measurement and anodic etching of the active layer, the mobility and concentration profile can be determined. A typical mobility and concentration profile is shown in Figure 3-8.

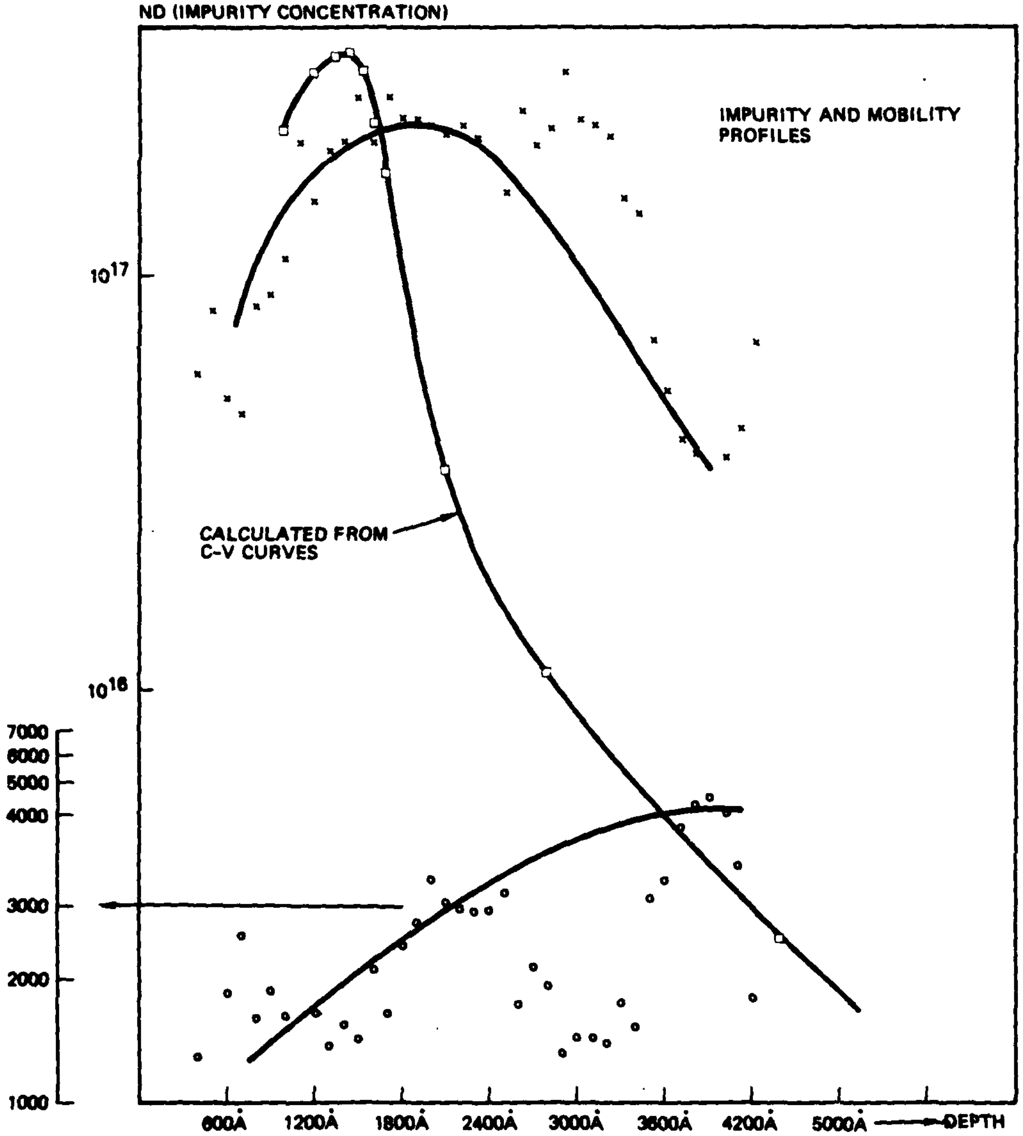


Figure 3-8. Impurity Concentration and Mobility Profile

Resistivity and Saturation Current of Probe FET Measurements

The mobility and impurity concentration profiling by Hall measurement technique is very tedious and not practical in characterizing each wafer. An economical and simple way to monitor the quality of ion-implantation is by measuring the sheet resistivity and FET saturation current after ohmic contact formation.

Resistor Bar Measurements

The channel sheet resistivity is a valuable process control parameter as well as a necessary design parameter for resistors. This parameter is measured using a 50 μm wide resistor bar consisting of three ohmic contacts separated by a one square channel region and a three squares channel region. Figure 3-9 shows the sheet resistivity distribution across the wafer. The variation is less than 10 percent which indicates the uniformity of ion-implantation. Of the same importance as sheet resistivity is the saturation current measurements. The saturation current of an FET can serve as an indication of good or bad ohmic contacts and quality of the wafers. As shown in Figure 3-9, the average saturation current is 44.5 mA for a 100 μm FET. The standard deviation is less than 10 percent across the wafer.

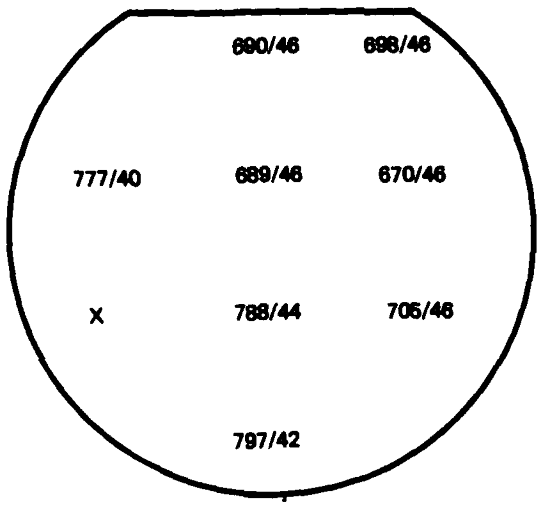


Figure 3-9. Sheet Resistivity and Saturation Current of 100 μm FET Across a Wafer of 1.5 in. in Diameter

3.2 ACTIVE DEVICES

FET's are the only active devices used in the X-band low noise amplifier. The primary development effort was directed toward improving the design criteria and minimizing parasitics to achieve the desired circuit performance. The device development was concentrated in two specific areas: 1-micron gate fabrication and improving ohmic contacts.

3.2.1 Device Isolation

The first step of the process sequence after ion-implantation and annealing is device isolation. The device isolation is accomplished by mesa etch in a solution of HF: H_2O_2: H_2O (1:1:3) at room temperature. This etch is known to be isotropic and has a gradual slope. These mesas are etched at a rate of about 1.8 micron per minute. Photolithographic patterns are used to delineate the mesas during this isolation etch. The depth of etch must be sufficient to go completely through the active layer to ensure device isolation.

3.2.2 Ohmic Contact Metallization

Ohmic contacts to GaAs have been extensively studied at TRW on an internally funded program and in other laboratories. The objective of these studies was to achieve metal semiconductor contacts which exhibit linear current-voltage characteristics and a contact resistance low in comparison to the resistance of the semiconductor device. This, in principle, is achieved either by:

- The choice of a metal which forms a low barrier with the semiconductor (thermionic emission)
- A high concentration region in the semiconductor near the contact so that the barrier is readily penetrated by quantum mechanical tunneling.

The tunneling approach was taken for the GaAs materials. In general, the objective was to reduce the specific contact resistance r_c to a value below 10^{-5} ohms-cm^2 by doping the semiconductor.

The low specific contact resistance was achieved by doping the GaAs with Ge from an AuGe contact. The Ge, an amphoteric dopant, goes substitutionally on vacant Ga sites to form donors. The doping occurs as the Au and Ge alloy with the topmost layer of the GaAs. When the GaAs-AuGe alloy

solidifies, Ge is distributed in the GaAs regrowth layer. Contacts formed in this manner yield a low ($\approx 10^{-5}$ ohm-cm^2) specific contact resistance.

The basic AuGe contact metallization has been used with and without variations in the structure. The variations included the use of additives such as Ag, In, Pt, and Ni to reduce the surface tension and minimize "balling" in the contact areas. For many of the early devices and the early circuit development, as shown in the process flow, the AuGe contact was used with a simple coating of Au for bonding purposes. These contacts are not uniform throughout the contact area or across the wafer but had many islands of contact metal in the ohmic contact region. This causes the ohmic contact resistance to be higher than that achievable with a more uniform contact.

The nonuniformity was, in part, attributed to cleanliness of the wafer prior to metal deposition and to localized segregation of metal clusters due to the high surface tension of the metal. A cleaning technique which removed surface oxides was developed and employed during the circuit fabrication. This technique uses dilute HCl to remove the oxides. The new cleaning procedure gave a higher yield of good contacts across a given wafer but the balling still existed. Balling was eliminated with the use of our present metal configuration and different sintering conditions. Metals with various thicknesses of Au, Ge, Au (top metal), and Ni or Pt were investigated. The system of Au-Ge-Ni-Au was employed in the monolithic circuits developed on this program.

After mesa etch, photoresist is coated onto the substrate and ohmic contact patterns are exposed and developed. 1700 Å of ohmic contact metal is then E-beam deposited and the excess metal is lifted off followed by alloying in nitrogen at 400°C for 30 seconds. Typical values of specific contact resistances achieved is of the order of 2×10^{-5} ohm cm^2 or less.

3.2.3 Gate Metallization (First Level Metal)

In the early stage of this program, our standard Schottky contact metallization was evaporated aluminum. This metal has been widely used in discrete GaAs MESFET's. It is easily evaporated, well defined by the standard liftoff techniques, adheres well to GaAs, and makes a good Schottky junction. The major drawback for this metal system is the difficulty

experienced in trying to make consistent, reliable, low-resistance via connections between metal-1 and metal-2. This problem is caused by the rapid oxidation of aluminum during deposition and subsequent processing steps. After exploring several alternatives, the Cr-Pt-Au metal system was adopted. This process has been refined such that we can routinely fabricate monolithic microwave integrated circuits with 1-micron gate length FET's.

The gate metal is 4500 Å thick and is produced by silox assisted photoresist liftoff technique. After ohmic contact formation, 4000 Å silox is deposited. Photoresist is spin coated and gate patterns are delineated. Silox is intentionally undercut to assist the gate metal liftoff. Cr-Pt-Au-Pt is then E-beam-deposited and the excess metal is lifted off in acetone.

Figure 3-10(a) shows the interdigited 360-micron FET with each finger of 90 microns. Figure 3-10(b) depicts a 1-micron gate line crossing over the mesa step. The measured metal resistivity is 4.2×10^{-6} ohm-cm and the sheet resistivity is 0.01 ohm per square. A typical I-V characteristics of the interdigited 360 micron FET is shown in Figure 3-11.

Figure 3-10 (a) Microphotograph of 360 μm Interdigeted FET (750X)

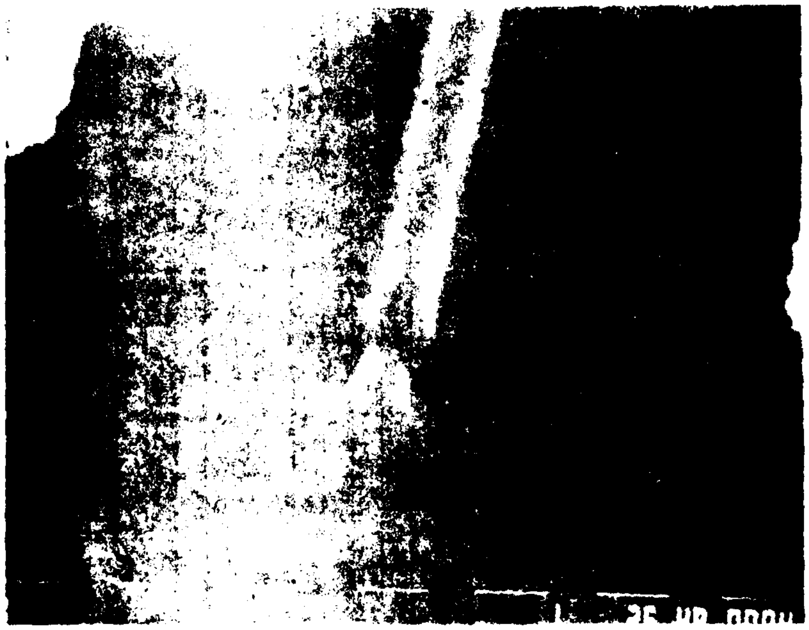


Figure 3-10 (... owing 1 Micron Gate Length Crossing ... 10,000X)

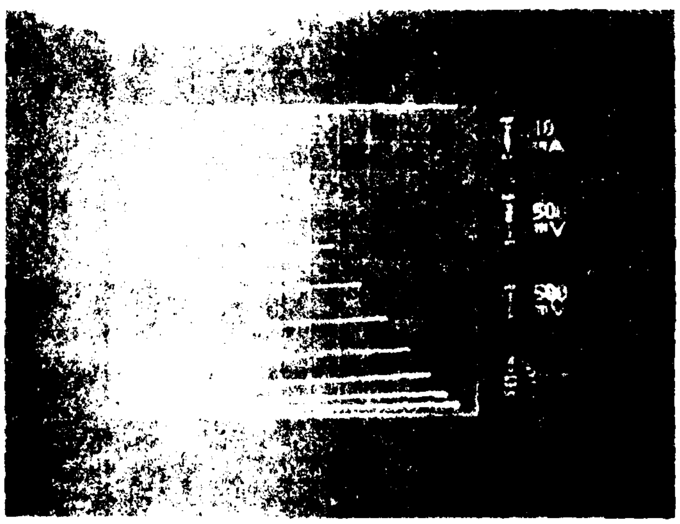


Figure 3- ... of a 360 μm Interdigited FET

3.3 PASSIVE COMPONENTS FABRICATION

Passive devices used in the X-band low noise preamplifier include resistors, capacitors and inductors. Two types of resistors, thin film and implanted bulk, were investigated. The capacitors are of metal-oxide-metal structure. The most serious problem encountered in IC fabrication was the cracking of silox in the large capacitors because of stress induced by thick aluminum deposited. This problem was solved by changing the top metal system from Ti-Al to Ti-Au, and using a thin layer of Ti as the topmost metal of the gate metal system. The inductor fabrication etch is straightforward. It uses a wet etch process to define the inductor patterns because of the undercut nature of wet etch process, metal thickness cannot be too thick. Our standard process uses 500 Å of titanium and 1 μm gold.

3.3.1 Resistors

Two types of resistors are used in fabricating GaAs IC's: Ion-implanted bulk resistors and thin film resistors. The n-doped (ion-implanted) GaAs material used as the active region of the MESFET has a sheet resistance in the order of 750 Ω/□ and is appropriate for noncritical high value resistors. Deposited Cr-Ge which sheet resistance of 100 to 200 Ω/□ can be used where precision resistors are required. These thin film resistors can be accurately trimmed and have good temperature and radiation stability. The penalties paid for the improved properties are added process complexity and additional metal evaporation. Since precise resistor values were not required the implanted bulk resistors were used.

3.3.2 Capacitors

A metal-oxide-metal capacitor plan view and cross-section are shown in Figure 3-12. The bottom plate of the capacitor is the same as the gate metal. After gate metal (or first level metal) lift off and sintering, silox is pyrolytically deposited to a thickness of 3000 Å followed by top metal deposition. The top capacitor plate is defined by photoresists pattern and etching the top metal.

The control of the capacitance value depends on the precision of silox deposition and the capacitor plate definition. Although a wet chemical etch process is employed to pattern the plate, the variation of plate size

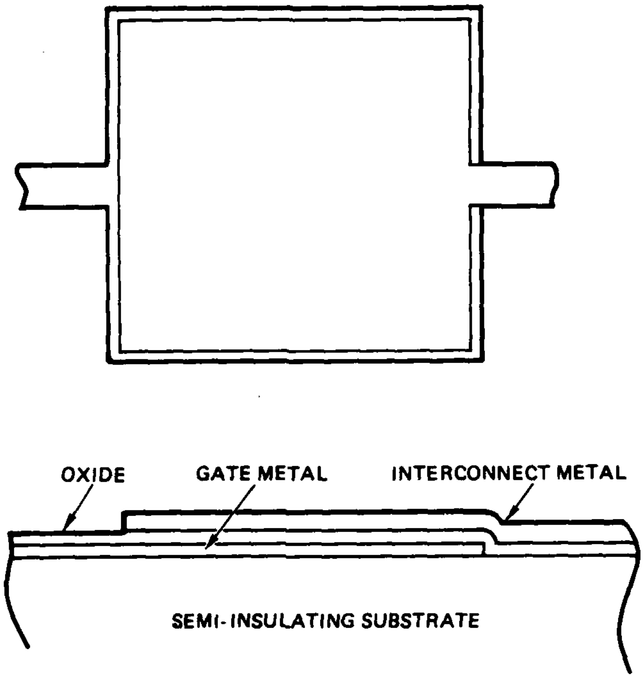


Figure 3-12. Metal-Oxide-Metal Capacitor

due to undercut is negligible. Most of the variation of capacitance value is due to silox thickness variation. The relative dielectric constant of silox is assumed to be 4.0.

A comparison of capacitance value measured and the design value is shown in Table 3-1, typically the discrepancy is within 10 percent of the designed value.

Initially, the top metal consisted of 500 Å Ti and 10,000 Å Al and the bottom plate was Cr-Pt-Au-Pt. The topmost layer of the bottom plate serves as a barrier to prevent Al alloying with gold in the gate in the via interconnect area. Because of the poor adhesion between platinum and silox, the stress induced by thick aluminum causes the silox to crack and peel off from the surface of bottom plate. Since the stress increases with the size of the plate, this cracking and peeling occurred mostly on the large capacitors. By adding a thin layer of titanium on top of platinum to improve the silox adhesion and change Ti-Al system to Ti-Au we are able to eliminate this problem.

Table 3-1. Measured Capacitance Value as Compared to the Designed Value

SAMPLES	$C_{CALCULATED}$ (pf)	$C_{MEASURED}$ (pf)	% ERROR
ONRPA-20	0.55	0.53	−3.6
	2.94	2.60	−11.6
	0.11	0.14	+27.3
ONRPA-38	0.19	0.21	+10.5
	0.42	0.38	+9.5
	1.14	0.92	+19.3
L3	0.82	0.76	−7.3
	0.27	0.27	0.0

IN CALCULATING OXIDE CAPACITANCE, RELATIVE DIELECTRIC CONST OF 4.0 IS USED

3.3.3 Inductors Process Development

At the beginning of this program, the standard metallization thickness for the top metal interconnection and inductor fabrication was 0.5 μm. It was recognized that this is less than one skin depth even at 12 GHz and therefore not optimum for microwave loss. However, the standard evaporation and pattern definition techniques made fabrication of thicker layers difficult. A straightforward extension of the standard processing has been successful in increasing the top metal thickness to 1 micron. This is approximately one skin depth at 10 GHz. Because fields can extend into the line from both sides, a thickness of 2 or more microns is desired for optimum inductor Q at 10 GHz. Doubling the thickness will nearly double the Q. However, to regain the top metal thickness will require longer etch time. Consequently, more undercut occurred and the line width is narrower. As a compromise 1 μm thick metal is used. Figure 3-13 shows a 2-1/4 turn inductor pattern. Gate metal is used as a center feed to the center of the inductor.

Figure 3-13. Microphotograph of a 2-1/4 Turns Inductor Pattern. The Magnification is 1000X

In order to evaluate the quality of the metallization at microwave frequencies, a series of LC test patterns such as those shown in Figure 3-14 were fabricated and measured. The S-parameters of the test pattern shunting a 50Ω line were measured to determine the equivalent circuit. The first order values for R, L, and C in a series connection were determined from the transmission resonance characteristic (DeLoach method). A more complex model was then derived which includes the parasitic bonding inductances and parasitic capacitance of the planar spiral inductor. This derivation uses COMPACT to optimally fit the equivalent circuit element values to the measured S-parameters. An example of the theoretical, first order, and complete equivalent circuits is shown in Figures 3-15 and 3-16. This data was generated for a test inductor pattern having a 1 μm thick metallization pattern. The DeLoach model is shown to give a reasonable approximation to the computer optimized value. However, the theoretical value is approximately 0.7 nH less than that measured. Excess wire bond inductance is suspected to be at least part of the explanation. In the computer optimization, it is difficult to separate the wire bond inductance from the inductor pattern. If it is assumed that the added inductance is a

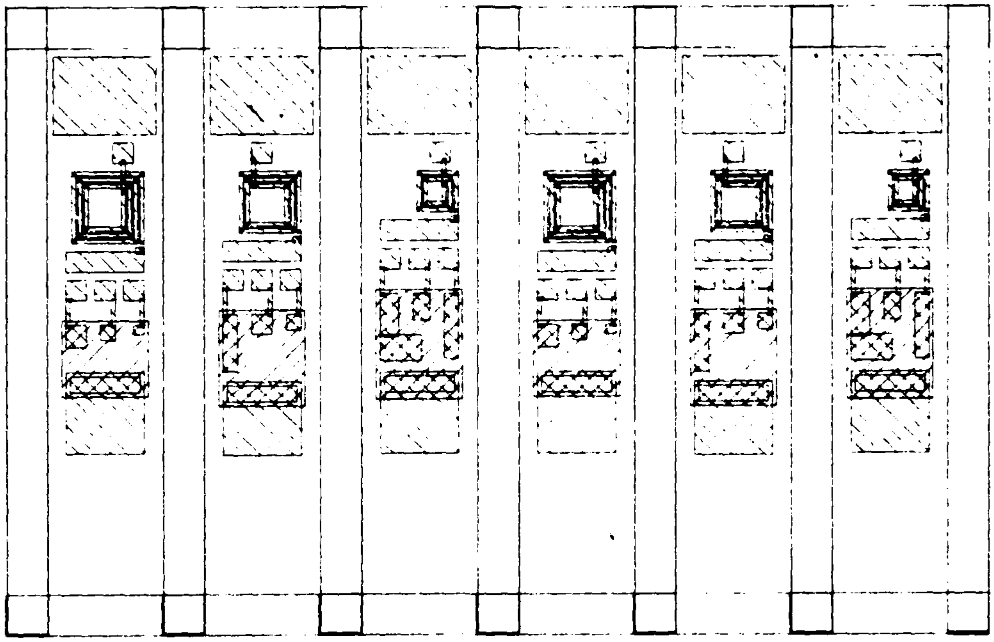


Figure 3-14. Layout of the L-C Test Patterns

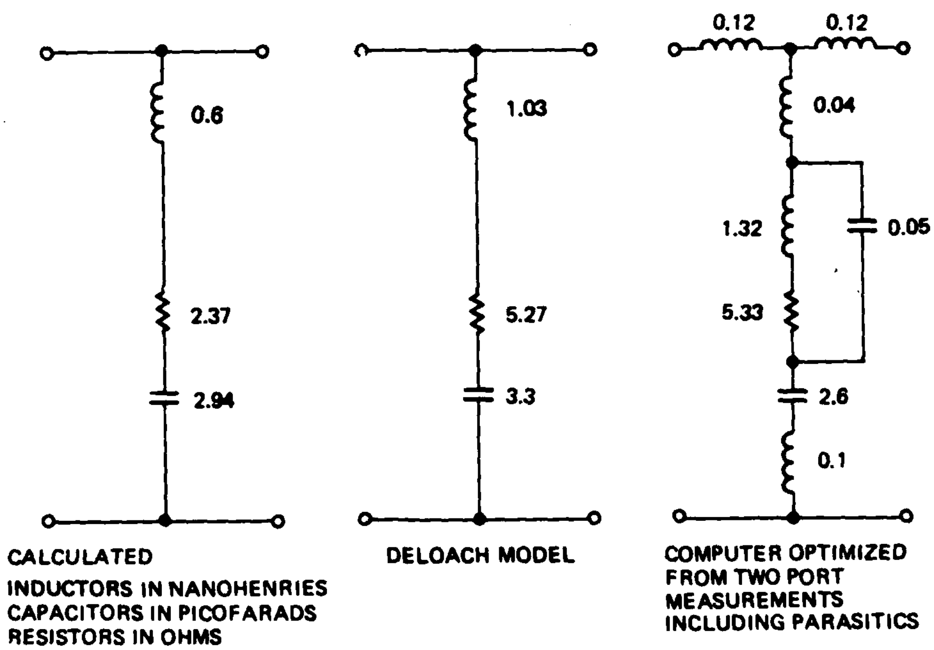


Figure 3-15. Inductor Measurement Sample No. 1 Equivalent Circuits

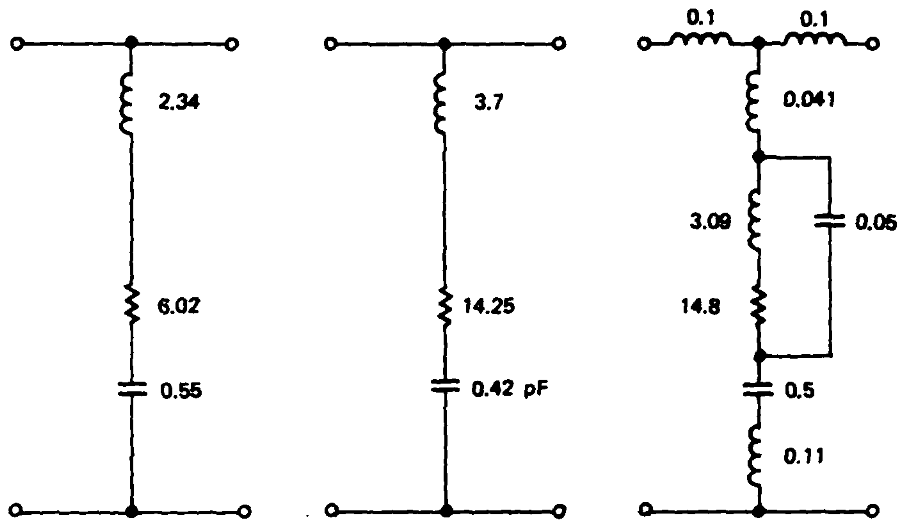


Figure 3-16. Inductor Measurement Sample No. 2 Equivalent Circuits

parasitic, a Q at 10 GHz can be estimated. The experimental Q is approximately 40 percent of the theoretical value and ranges from 7 to 9. At this time the source of the extra loss is not known. Suspected sources are resistance in the gate metal layer used for the capacitor and resistance in the via connections from bottom to top metal. Until the source of the extra loss is identified and eliminated, the increased thickness in top metallization may not have a significant impact on the Q of the series resonant circuit.

3.4 CIRCUIT FABRICATION

The X-band amplifier, configured by eight low noise MESFET stages and their associated input and output matching network, is diagrammed in a composite layout in Figure 3-17. It includes eight interdigited 360 μm MESFET with 1 μm gate length; each finger is 90 μm wide, twenty inductors and six bulk resistors and twenty-two capacitors. The amplifier size is 2.5 mm X 5.0 mm. In order to monitor the IC processing steps, a process evaluation cell has been developed and used in this program. The process evaluation devices include:

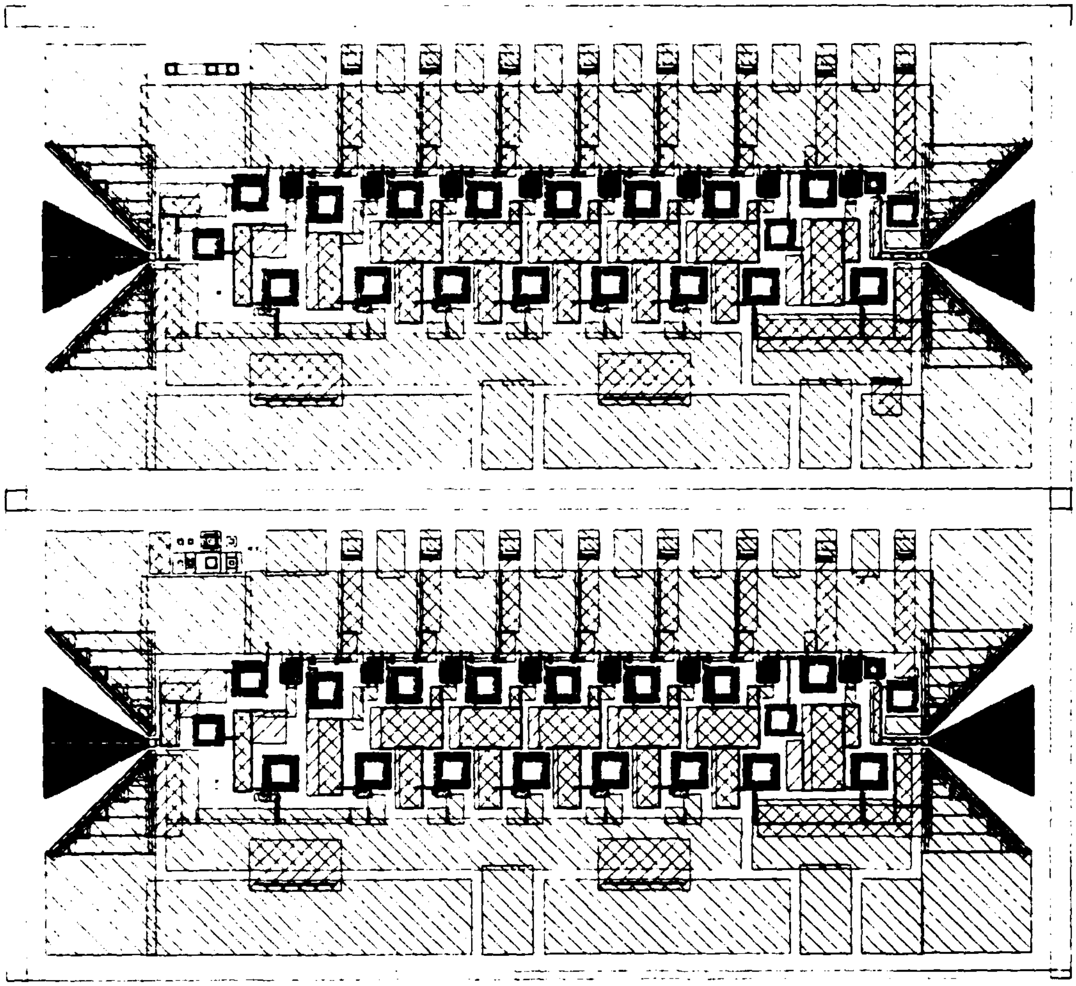


Figure 3-17. *Complete 8-Stage MESFET Low Noise Preamplifier for 8 to 11 GHz Bandwidth*

1) 100 μm x 1 μm FET

2) Twenty five 360 μm x 1 μm FET

3) Resistor bar (50 μm x 50 μm contact)

4) MOM capacitors

5) Ohmic contact string

6) Gate contact string

7) Gate/top metal serpentine

8) Ohmic/top metal serpentine

9) Mesa etch isolation pattern.

For circuit diagnosis purposes, a one-stage and two-stage preamplifier and L-C test patterns are included in the test area. A complete layout of the test area is shown in Figure 3-18.

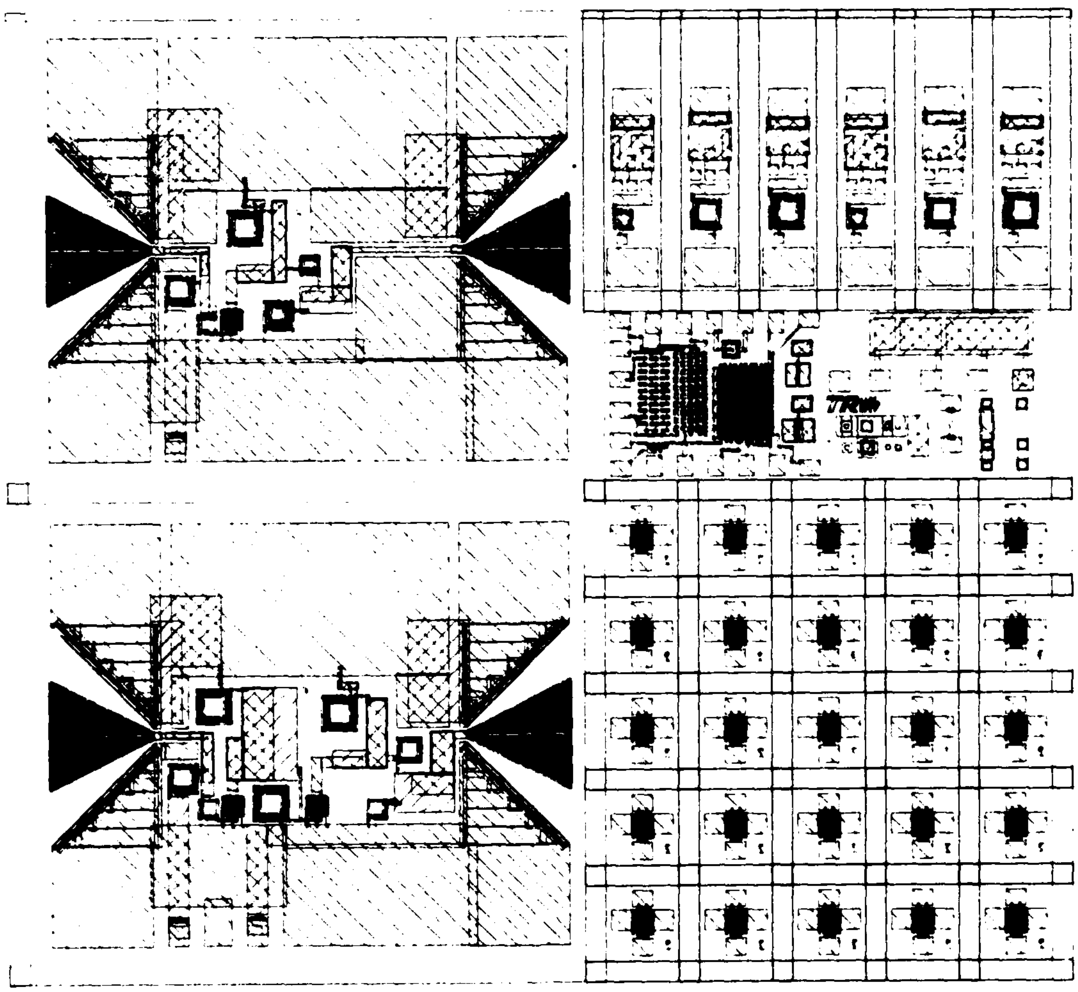


Figure 3-18. Test Cell Including (1) Test Pattern, Process Evaluation Devices, Discrete 360 μm FET, One and Two-Stage Preamplifier

3.5 INTERCONNECT AND ISOLATION TECHNIQUE

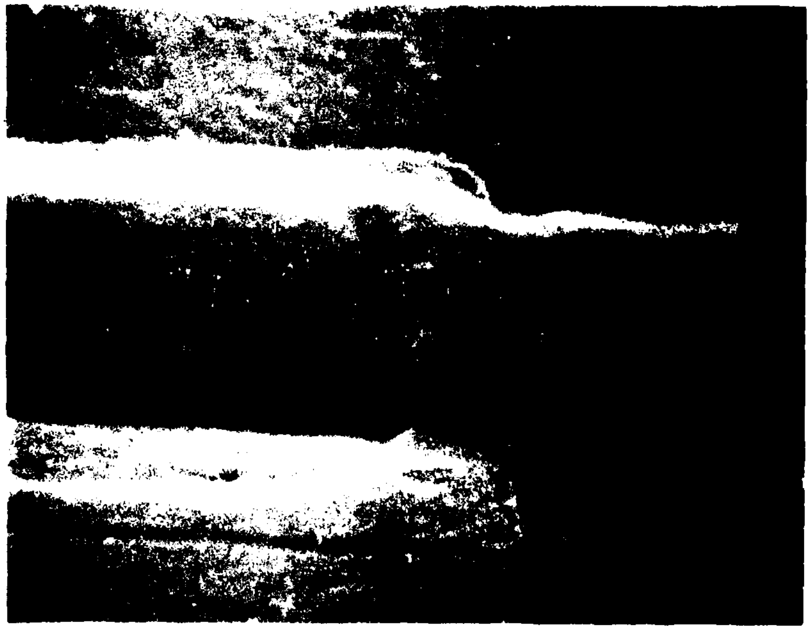
Most of the circuit elements are joined by the second level metal (or top metal); however, some connections through undercrossings are made with conductors which are deposited and defined along with the capacitor plates and gates. 3000Å of Silox formed by the oxidation of silane at 390°C is used as interlayer dielectric for isolation purposes as is the dielectric for the capacitors. After the silox is deposited, via holes are etched into it to permit contact to the top metal consisting of 500Å titanium and 10,000Å gold.

The Ti-Au metal system is chosen because gold is a good conductor, has low resistivity, and is easily bonded, while titanium makes low resistance contacts to the first level metal including bottom plates of capacitor, center feeds of inductor, gates, and ohmic contacts. The Ti-Au metal system is E-beam-deposited in a vacuum. Photoresist is then coated and patterned, followed by wet etch to refine the interconnect metal patterns.

Two interconnection problems occured during the course of this program: 1) the step coverage problem over the sidewall of via holes and the gate metal steps and 2) the interconnect to the Al gate metal during the program's early stages due to the oxidation of Al surface. Replacing the Al gate by Cr-Pt-Au-Pt-Ti as discussed previously has resolved this problem. The step coverage problem over the via hole is shown in Figure 3-19 (a); break in the top metal occurs because of the sharp step of the via hole. An improved process has been developed to etch the via such that the via sidewall is gradual. The step coverage improved with oxide contour is shown in Figure 3-19(b).

The step coverage over gate metal is always a problem because the conventional CVD silox tends to create a inverted slope as shown in the drawing of Figure 3-20, which makes the good smooth step coverage almost impossible. Figure 3-21 shows a typical step coverage of top metal over first level metal, notice the continuity at the bottom of the step. It is believed that this poor step coverage causes serious yield problems. One possible solution is to sputter deposit silox to smooth out the sharp corner of the first level metal. A Perkin Elmer sputtering machine was purchased but because of delay in delivery and some mechanical problems the sputtering

(a) Break Due to Oxide Slope



(b) Step Coverage Improved with Oxide Contour

Figure 3-19. Step Coverage of Top Metal Crossing Over the Via Opening (a) Sharp Slope. (b) Gradual Slope

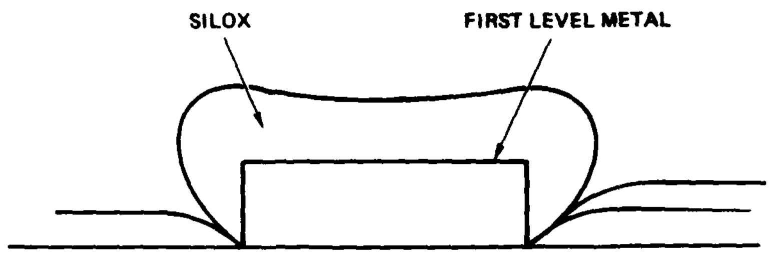


Figure 3-20. Simulating the Step Coverage of 4000 Å Silox over 4500 Å First Level Metal

Figure 3-21. Microphotograph of Top Metal Crossing Over First Level Metal

silox was not implemented into the IC process at the time this program completed. Since then we have developed a company proprietary process which completely eliminates the step coverage problem. Figure 3-22 illustrates the good smooth step coverage of top metal resulting from this new process.

Figure 3-22. Microphotograph of 4 μm Undercrossing Metal. (2000X)

4. RF CHARACTERIZATION

4.1 ACTIVE DEVICE CHARACTERIZATION

To evaluate process repeatability between wafers and FET computer model accuracy, the scattering parameters of several FET samples from different wafers were measured at various drain current levels.

A list of the working devices that were characterized is shown in Table 4-1.

Table 4-1. Characterized Devices

WAFER NUMBERS	DEVICE NUMBERS
ONR-10	2,3,4,5
ONR-20	1,2,3
ONR-21	1,2,3
ONR-28	3,5
ONR-38	1,2,3,4
PAC-2 No. 9	1,2,3,5,6,7,8,9

Automatic Network Analyzer (ANA) listings of measured scattering parameters for these devices are given in Appendix A. Wafer PAC-2, NO. 9 differs from wafers ONR-10 through ONR-38 in the planar process used in fabrication.

Existing discrepancies between the measured results and the FET computer model will be discussed in Section 6.

4.2 PASSIVE COMPONENT CHARACTERIZATION

Several RLC samples from different wafers were characterized in two parts; associated parasitics were estimated from mechanical measurements and then subtracted by computer optimization routines. This characterization process permitted the accurate evaluation of TRW's microelectronic inductor computer model; further comments on this model as well as it's correlation with the measured values are included in Section 6.

A list of the characterized RLC circuits is shown in Table 4-2.

Table 4-2. Characterized RLC Samples

WAFER NUMBER	SAMPLE NUMBER
Experimental	1,2
ONR-38	3,4,5,7
L4-A	1,2

ANA listings of measured scattering parameters for these RLC circuits are given in Appendix B. Wafer L4-A was processed to achieve 3 μm metal thicknesses on the inductors; the experimental wafer as well as ONR-38 have metallization thicknesses of 0.5 to 1.0 μm.

4.3 PREAMPLIFIER CHARACTERIZATION

The gain-frequency response characteristic was measured for several eight-stage amplifiers from different wafers. A list of these devices is shown in Table 4-3.

Table 4-3. Characterized Eight-Stage Amplifier

WAFER NUMBER	DEVICE NUMBER
ONR-10	1
ONR-21	1,2
ONR-28	1
ONR-37	2-1
ONR-38	1-5, 1-6, 1-7, 43-03

Automatic Network Analyzer listings of measured scattering parameters for these devices are provided in Appendix C. Analysis of discrepancies between predicted and actual performance will be discussed in Section 6. Test data of the deliverable units is given in Appendix D.

5. COMPARISON OF PREAMPLIFIER PERFORMANCE GOALS AND ACTUAL PERFORMANCE

The original design goals for the preamplifiers were:

- Gain 30 dB at 10 GHz
- Frequency Response 8.0 to 11.0 GHz
- Noise Figure $\leq$3.0 dB at 10 GHz

At the end of the evaluation phase of the preamplifier the measured performance characteristics for the best unit were:

- Gain 20 dB at 6 GHz
- Frequency Response 3.0 to 9.0 GHz
- Noise Figure 8.0 dB at 6.0 GHz

As shown, the measured gain was lower than the predicted gain. The frequency response was shifted to lower frequencies and the noise figure was higher than expected. Section 6 will include an analysis of these discrepancies.

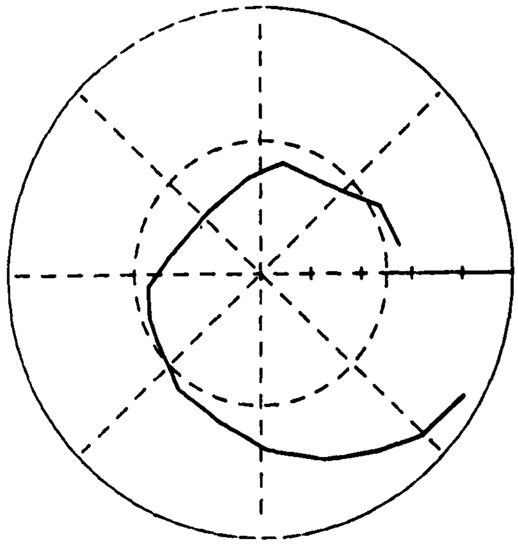
6. ANALYSIS OF DISCREPANCIES

During the evaluation phase of the Monolithic Microwave Preamplifier program, existing discrepancies between predicted performance and actual measurements were found to be originated by

- Discrepancies between theoretical and measured FET device S-parameters
- Discrepancies between theoretical and measured inductor values and their associated Q values

Discrepancies between theoretical and measured S-parameters for the FET used in the amplifier are shown in Figures 6-1 through 6-8. The greatest differences are exhibited by S_{11} and S_{21}. Consequently, it can be concluded that in the present design the devices are severely mismatched at the input and that their corresponding forward power transfer is considerably less than expected. The impact analysis of measured FET data on the amplifier frequency response is shown in Figure 6-9. The dashed line indicates the predicted performance of the preamplifier with theoretical FET S-parameters and inductor parameters, the solid line indicates the actual measured performance of the best unit, and the broken line is the theoretical performance with measured FET S-parameters and theoretical inductor parameters. Discrepancies between theoretical and measured values and associated parasitic ohmic resistances are shown in Table 6-1.

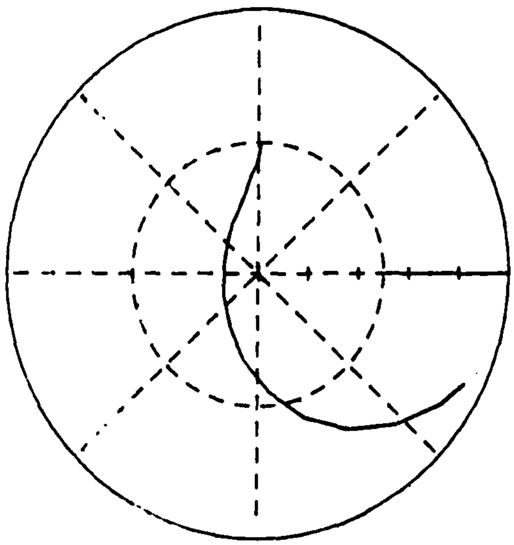
ONR 20-2 Vd=4 Id=60 Vg=-2.7



S11: POLAR FULL SCALE 1

Figure 6-1. Measured S_{11}

360uM DEVICE Vd=3 Id=30



S11: POLAR FULL SCALE 1

Figure 6-2. Theoretical S_{11}

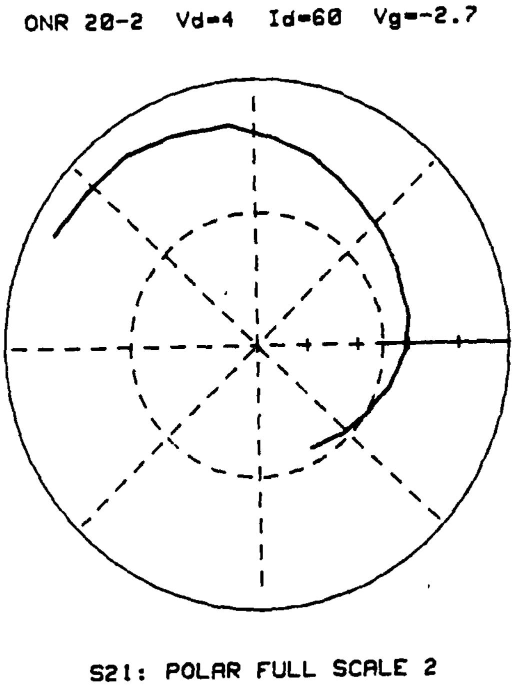


Figure 6-3. Measured S_{21}

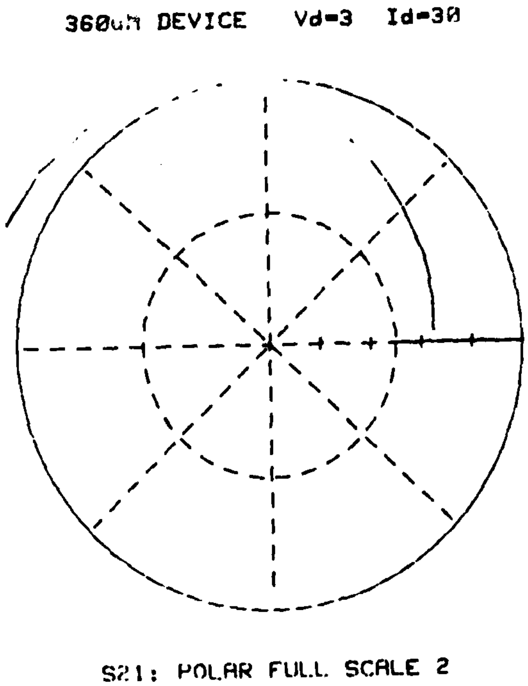
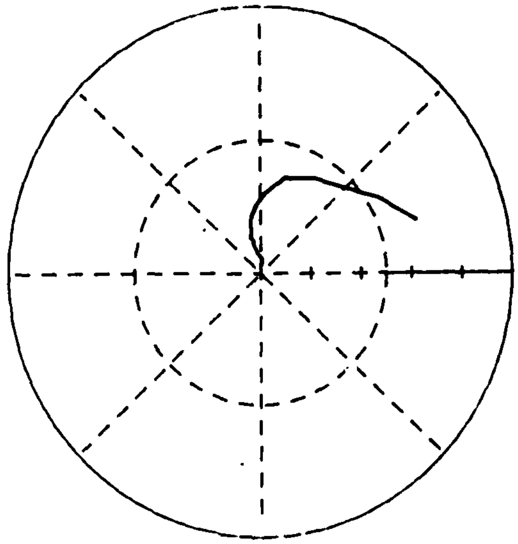


Figure 6-4. Theoretical S_{21}

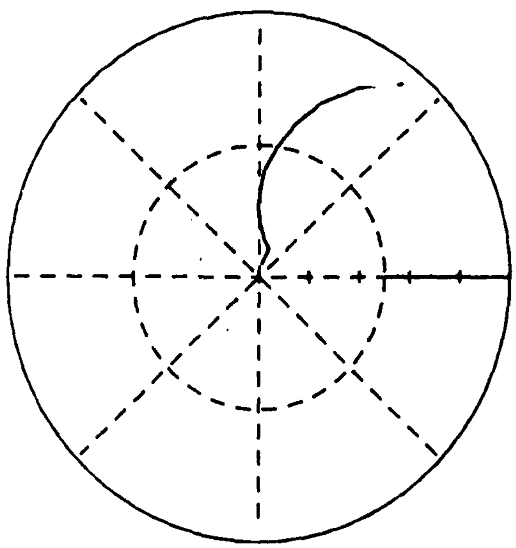
ONR 20-2 Vd=4 Id=60 Vg=-2.7



S12: POLAR FULL SCALE .5

Figure 6-5. Measured S_{12}

360uM DEVICE Vd=3 Id=30



S12: POLAR FULL SCALE .5

Figure 6-6. Theoretical S_{12}

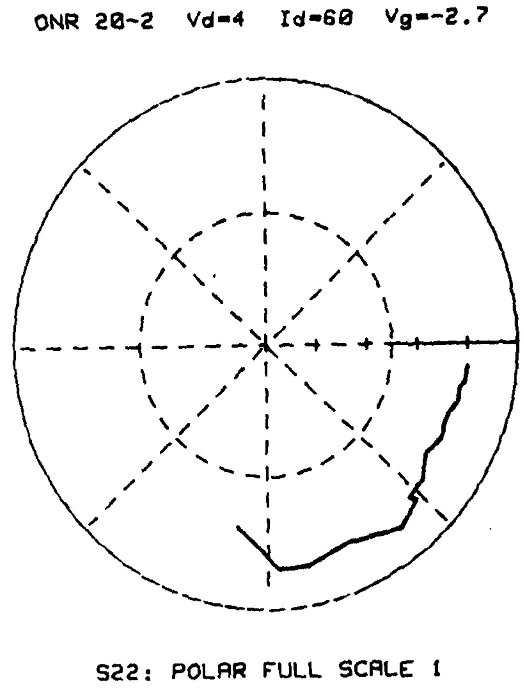


Figure 6-7. Measured S_{22}

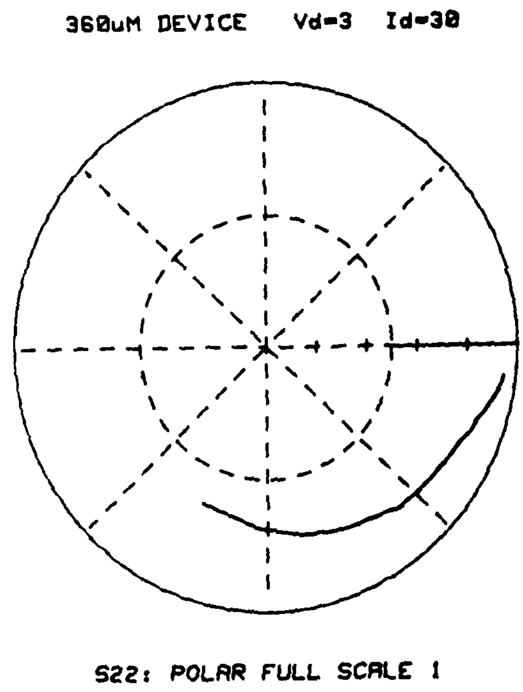


Figure 6-8. Theoretical S_{22}

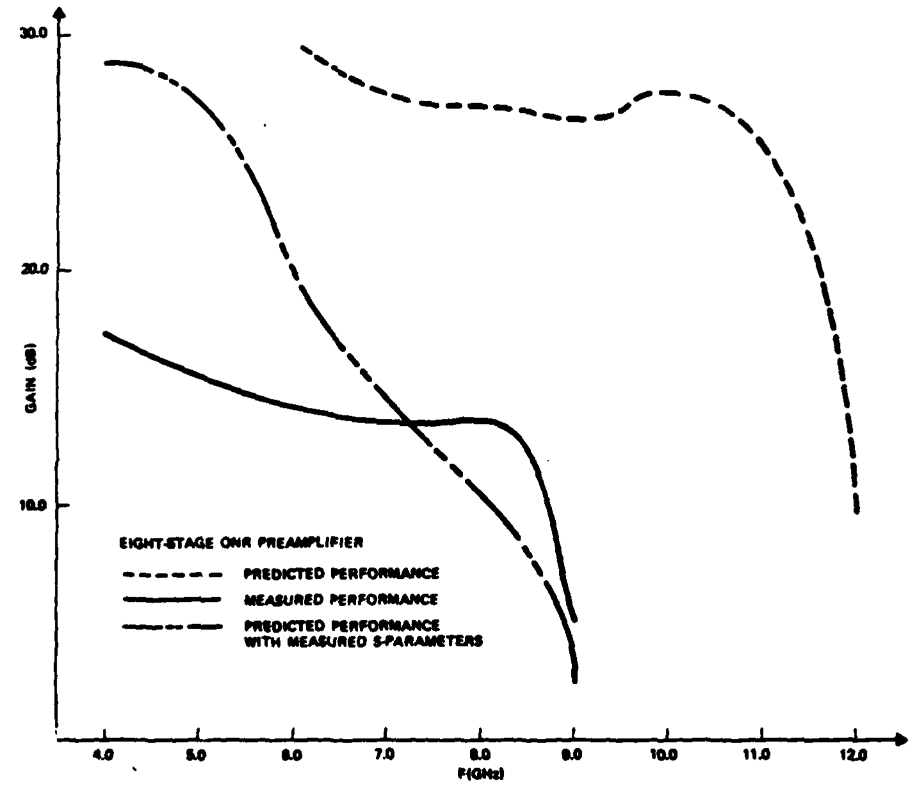


Figure 6-9. Eight-Stage ONR Amplifier Frequency Response

Table 6-1. Discrepancies in Inductor Values (Values are in Nanohenries, Ohms, and Picofarads)

SAMPLE NUMBER		CALCULATED	DELOACH MEASUREMENT	COMPUTER-FITTED DATA
Experimental No. 1	L	0.6	1.03	1.32
	R	2.37	5.27	5.33
	C	2.94	3.3	2.6
Experimental No. 2	L	2.34	3.7	3.09
	R	6.21	14.25	14.78
	C	0.55	0.42	0.50
ONR-38 No. 3 Run 1	L	1.34	2.03	1.8
	R	4.17	8.92	8.26
	C	1.14	0.92	0.92
ONR-38 No. 3 Run 2	L	1.34	1.88	1.76
	R	4.17	11.82	12.36
	C	0.19	0.21	0.21
ONR-38 No. 4 Run 1	L	1.34	1.93	1.6
	R	4.17	7.89	7.49
	C	0.57	0.56	0.60
ONR-38 No. 4 Run 2	L	1.34	2.08	1.75
	R	4.17	9.15	10.15
	C	0.19	0.23	0.23
ONR-38 No. 5 Run 1	L	2.34	3.02	2.84
	R	6.21	17.09	18.95
	C	0.11	0.15	0.14
ONR-38 No. 7 Run 1	L	0.6	1.31	1.1
	R	2.48	5.98	5.3
	C	0.42	0.38	0.38
L4-A No. 1	L	1.3	1.57	1.37
	R	1.05	4.21	3.6
	C	0.38	0.43	0.42
L4-A No. 2	L	1.30	1.76	1.41
	R	1.05	4.21	3.45
	C	0.38	0.39	0.42

From these measurements it can be observed that all measured inductor values are higher than the theoretical values. One immediate consequence of this fact is a shift of the frequency response characteristic to a lower band than theoretically predicted; this agrees in principle with the measured results. The impact analysis of these discrepancies on the amplifier's frequency response is shown in Figure 6-10. The dashed line indicates the predicted performance of the preamplifier with theoretical FET S-parameters and inductor parameters; the solid line indicates the actual measured performance of the best unit, and the broken line indicates the theoretical performance with measured inductor parameters and theoretical FET S-parameters. The predicted gain-frequency characteristic using measured inductor data starts at 58.3 dB of gain at 4.0 GHz followed by a flat segment of 40 dB gain between 6.0 and 10.0 GHz, then dropping to 6.1 dB of gain at 12 GHz. Figure 6-10 shows a section of this curve for frequencies above 12 GHz.

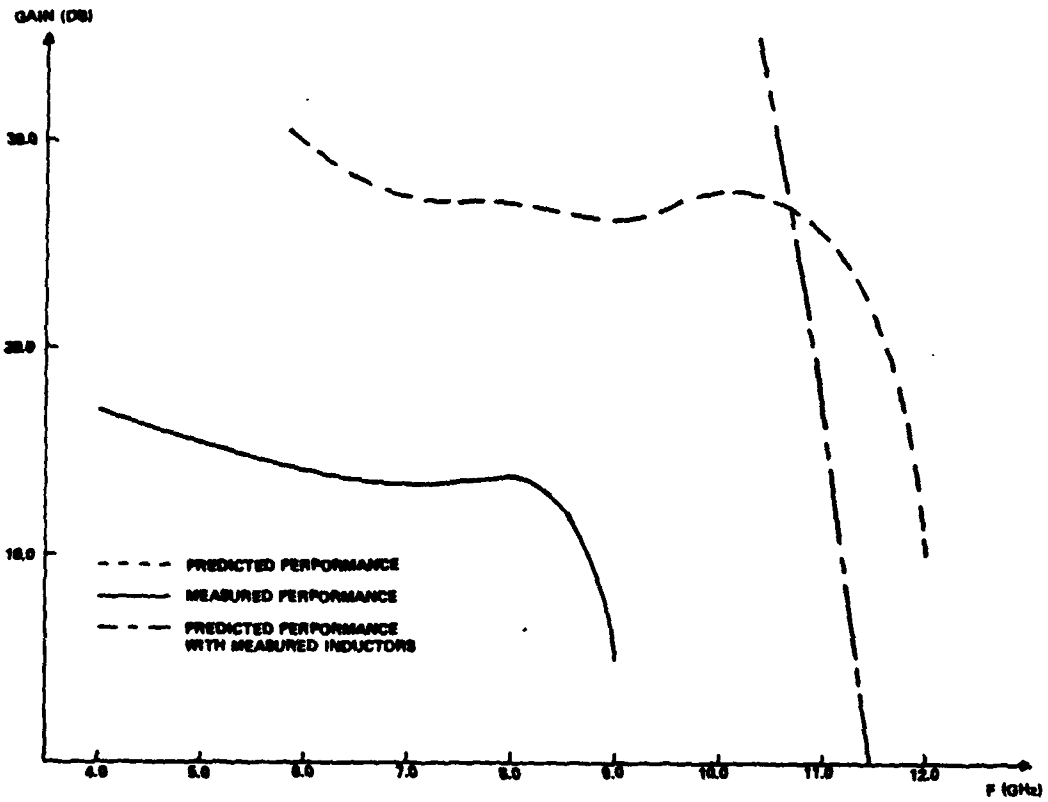


Figure 6-10. Eight-Stage ONR Amplifier Frequency Response

7. CONCLUSIONS AND RECOMMENDATIONS

It has been concluded that the preamplifier design is highly dependent on the accuracy of the FET S-parameters and noise parameters, since the differences between the predicted and measured performances can be largely explained by the substantial discrepancies that exist within the theoretical and actual parameters of the FET's. To a lesser degree, the differences between predicted and measured values of the planar rectangular inductors contribute significantly to the inequalities of the preamplifier's performances. TRW's theoretical design capabilities for circuit analysis and synthesis appear to be adequate since a close correlation was established between the preamplifier performance data and the analyzed predicted circuit performance using measured FET S-parameters and inductor parameters.

In addition to these conclusions, a large data base for FET devices and inductors must be accumulated, the inductor computer model requires refinment to enhance it's accuracy at higher microwave frequencies, and GaAs integrated circuit processing must be improved to yield better FET device performance.

It is recommended that a second design iteration be made on this preamplifier using measured FET and inductor parameters drawn from a large data base. Significant processing improvements can also be made on channel profile optimization, controlled channel etching, better metal deposition techniques for gate metal formation, and improved dielectric deposition techniques to achieve good step coverage.

APPENDIX A

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #2 VDD=4V ID=31.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.928	-36	1.144	147	.037	74	.774	-5
2200.000	.917	-40	1.141	143	.041	72	.771	-6
2400.000	.909	-44	1.148	140	.044	71	.768	-7
2600.000	.893	-48	1.145	136	.048	69	.764	-8
2800.000	.885	-52	1.148	132	.051	67	.765	-9
3000.000	.869	-57	1.144	129	.054	65	.759	-10
3200.000	.849	-62	1.137	125	.057	63	.756	-11
3400.000	.833	-66	1.125	121	.059	61	.752	-12
3600.000	.814	-71	1.105	117	.060	59	.747	-14
3800.000	.798	-76	1.091	113	.062	57	.741	-15
4000.000	.773	-80	1.064	110	.063	55	.734	-16
4200.000	.770	-84	1.030	107	.063	54	.730	-17
4400.000	.763	-88	1.014	104	.065	53	.725	-18
4600.000	.758	-92	.993	101	.066	52	.722	-19
4800.000	.756	-96	.977	98	.067	51	.722	-20
5000.000	.753	-100	.957	95	.068	49	.724	-21
5200.000	.750	-103	.947	92	.069	48	.728	-22
5400.000	.737	-107	.927	89	.070	46	.731	-23
5600.000	.722	-111	.910	86	.071	42	.731	-24
5800.000	.687	-114	.878	83	.071	38	.724	-24
6000.000	.637	-117	.833	80	.063	28	.716	-23
6200.000	.618	-116	.803	80	.048	37	.721	-22
6400.000	.622	-118	.802	79	.049	49	.723	-23
6600.000	.625	-122	.802	77	.055	51	.719	-24
6800.000	.619	-125	.791	75	.058	51	.708	-25
7000.000	.615	-129	.778	73	.059	51	.696	-26
7200.000	.613	-133	.770	71	.060	51	.687	-26
7400.000	.617	-136	.766	69	.061	51	.679	-28
7600.000	.617	-139	.755	67	.061	51	.682	-29
7800.000	.613	-142	.754	65	.061	51	.684	-30
8000.000	.611	-145	.751	63	.062	52	.685	-31
8200.000	.614	-149	.742	59	.064	51	.722	-31
8400.000	.600	-152	.733	57	.064	51	.729	-32
8600.000	.582	-156	.718	54	.064	51	.727	-33
8800.000	.568	-160	.706	52	.064	50	.718	-33
9000.000	.567	-163	.690	50	.064	51	.708	-34
9200.000	.574	-166	.670	48	.063	52	.687	-35
9400.000	.581	-169	.661	46	.063	53	.670	-36
9600.000	.587	-172	.652	45	.064	54	.662	-35
9800.000	.604	-176	.646	43	.066	54	.639	-36
10000.00	.628	-178	.640	41	.068	54	.624	-38
10200.00	.647	-179	.638	39	.069	54	.622	-42
10400.00	.658	180	.634	37	.070	53	.625	-45
10600.00	.661	-179	.636	35	.072	53	.644	-49
10800.00	.635	-179	.627	31	.072	52	.681	-52
11000.00	.601	-178	.618	28	.074	50	.719	-55
11200.00	.538	-176	.604	24	.074	49	.774	-57
11400.00	.441	-174	.577	20	.075	47	.830	-57
11600.00	.410	-167	.517	19	.071	46	.807	-59
11800.00	.395	-168	.500	23	.072	49	.762	-56
12000.00	.379	-173	.510	26	.073	50	.743	-51
12200.00	.511	174	.591	22	.079	49	.778	-53

12400.00	.456	160	.586	18	.080	48	.755	-48
12600.00	.468	134	.550	15	.085	46	.705	-48
12800.00	.545	133	.541	12	.086	44	.641	-52
13000.00	.584	131	.538	9	.086	42	.610	-56
13200.00	.607	134	.531	6	.086	39	.599	-64
13400.00	.610	138	.521	3	.086	38	.620	-73
13600.00	.587	143	.504	0	.085	36	.675	-80
13800.00	.539	148	.486	-3	.085	35	.732	-84
14000.00	.528	151	.464	-3	.084	35	.720	-84
14200.00	.528	147	.463	-2	.087	37	.705	-80
14400.00	.486	138	.470	-4	.091	35	.711	-74
14600.00	.446	126	.474	-5	.094	34	.735	-69
14800.00	.421	114	.476	-8	.096	33	.754	-64
15000.00	.436	103	.475	-11	.099	31	.749	-62
15200.00	.470	97	.473	-14	.102	29	.738	-61
15400.00	.504	93	.465	-17	.106	27	.704	-62
15600.00	.534	91	.467	-19	.109	25	.666	-65
15800.00	.561	89	.452	-22	.113	22	.640	-68
16000.00	.571	88	.449	-25	.115	19	.617	-72
16200.00	.562	85	.443	-27	.118	17	.612	-76
16400.00	.555	82	.434	-30	.120	15	.618	-79
16600.00	.545	81	.428	-32	.124	12	.616	-82
16800.00	.548	77	.423	-33	.125	9	.613	-84
17000.00	.560	73	.414	-36	.125	7	.616	-84
17200.00	.569	67	.412	-38	.128	5	.614	-84
17400.00	.583	63	.410	-41	.129	4	.604	-85
17600.00	.601	60	.401	-43	.132	2	.596	-86
17800.00	.613	59	.396	-44	.136	1	.568	-87
18000.00	.617	57	.393	-47	.142	-1	.554	-90

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #3 VDD=4V ID=32.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG.	MAG	ANG
2000.000	.932	-35	1.170	147	.033	74	.783	-6
2200.000	.923	-39	1.166	143	.036	72	.781	-7
2400.000	.916	-43	1.174	140	.040	71	.778	-8
2600.000	.902	-47	1.171	136	.042	69	.773	-9
2800.000	.898	-51	1.175	133	.045	68	.776	-10
3000.000	.884	-55	1.173	129	.048	65	.768	-11
3200.000	.867	-60	1.168	125	.050	63	.764	-13
3400.000	.852	-64	1.156	121	.052	62	.759	-14
3600.000	.834	-68	1.140	117	.053	59	.753	-16
3800.000	.820	-72	1.129	114	.055	58	.745	-17
4000.000	.796	-76	1.106	110	.057	56	.738	-19
4200.000	.793	-79	1.072	108	.057	55	.732	-20
4400.000	.785	-83	1.061	104	.058	54	.727	-22
4600.000	.778	-87	1.044	102	.059	52	.724	-24
4800.000	.776	-91	1.032	98	.061	51	.726	-25
5000.000	.773	-95	1.017	95	.062	49	.728	-27
5200.000	.767	-98	1.009	92	.063	47	.735	-29
5400.000	.753	-102	.990	89	.065	45	.738	-30
5600.000	.737	-106	.974	84	.066	40	.738	-32
5800.000	.698	-110	.935	81	.065	32	.729	-32
6000.000	.638	-112	.875	78	.053	18	.716	-31
6200.000	.632	-111	.847	79	.037	35	.726	-30
6400.000	.639	-114	.851	77	.041	50	.733	-31
6600.000	.641	-118	.848	75	.047	52	.730	-32
6800.000	.636	-122	.833	73	.049	51	.719	-33
7000.000	.632	-126	.817	71	.050	51	.709	-34
7200.000	.632	-129	.808	69	.051	51	.701	-35
7400.000	.638	-133	.804	67	.051	51	.695	-36
7600.000	.641	-135	.794	65	.051	52	.699	-38
7800.000	.638	-138	.794	63	.052	52	.702	-38
8000.000	.638	-141	.794	60	.052	53	.702	-39
8200.000	.642	-144	.789	57	.055	52	.739	-39
8400.000	.627	-147	.781	54	.055	52	.744	-41
8600.000	.608	-150	.767	52	.055	51	.738	-41
8800.000	.589	-153	.757	49	.055	51	.726	-42
9000.000	.582	-157	.741	46	.055	51	.710	-44
9200.000	.587	-159	.722	44	.055	52	.691	-46
9400.000	.589	-162	.715	42	.056	53	.674	-47
9600.000	.590	-166	.708	41	.057	54	.666	-48
9800.000	.604	-170	.707	39	.059	54	.647	-50
10000.00	.624	-173	.704	36	.061	53	.638	-53
10200.00	.642	-175	.702	33	.062	52	.646	-58
10400.00	.653	-177	.698	30	.063	50	.661	-62
10600.00	.657	-177	.697	27	.064	48	.694	-66
10800.00	.630	-177	.682	23	.065	47	.736	-68
11000.00	.599	-176	.665	19	.065	44	.776	-71
11200.00	.538	-175	.640	15	.064	42	.823	-72
11400.00	.443	-173	.600	11	.064	40	.859	-71
11600.00	.415	-167	.530	11	.060	39	.821	-71
11800.00	.403	-167	.519	16	.061	43	.775	-66
12000.00	.389	-171	.537	19	.062	44	.758	-60
12200.00	.522	176	.638	14	.070	43	.827	-62

12400.00	.462	163	.634	10	.071	41	.790	-58
12600.00	.467	136	.602	6	.077	38	.729	-60
12800.00	.540	135	.595	3	.077	35	.667	-66
13000.00	.575	133	.595	-0	.078	31	.640	-72
13200.00	.593	135	.588	-5	.078	27	.641	-81
13400.00	.593	138	.575	-8	.078	25	.672	-89
13600.00	.564	143	.553	-12	.076	22	.730	-95
13800.00	.511	147	.529	-15	.075	20	.778	-97
14000.00	.496	148	.505	-15	.074	21	.759	-96
14200.00	.489	143	.506	-15	.078	21	.753	-92
14400.00	.450	130	.518	-17	.082	19	.763	-86
14600.00	.419	116	.522	-20	.084	16	.787	-81
14800.00	.412	102	.522	-23	.087	13	.803	-78
15000.00	.442	92	.516	-27	.089	11	.793	-77
15200.00	.486	87	.510	-29	.091	9	.774	-76
15400.00	.525	85	.496	-33	.094	6	.736	-78
15600.00	.558	84	.496	-35	.097	4	.700	-80
15800.00	.582	84	.480	-38	.099	1	.673	-83
16000.00	.596	82	.479	-40	.102	-2	.652	-86
16200.00	.581	80	.477	-42	.105	-4	.651	-88
16400.00	.570	78	.471	-45	.108	-7	.655	-90
16600.00	.556	76	.469	-48	.112	-9	.648	-92
16800.00	.558	72	.466	-50	.115	-12	.639	-93
17000.00	.565	67	.466	-52	.116	-15	.634	-93
17200.00	.571	61	.464	-56	.120	-18	.624	-93
17400.00	.584	55	.468	-59	.122	-19	.605	-94
17600.00	.602	50	.460	-62	.127	-21	.586	-96
17800.00	.612	50	.453	-64	.130	-22	.550	-98
18000.00	.621	46	.456	-68	.138	-26	.532	-103

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

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JUNE 9/80

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1)

#4 VDD=4V ID=9.3MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.945	-28	.980	149	.043	74	.801	-8
2200.000	.938	-31	.981	146	.047	73	.799	-9
2400.000	.932	-34	.991	143	.051	71	.796	-10
2600.000	.919	-37	.992	140	.055	69	.792	-12
2800.000	.917	-41	.999	137	.059	68	.796	-13
3000.000	.903	-44	1.002	133	.063	65	.789	-14
3200.000	.889	-48	1.001	129	.066	63	.785	-16
3400.000	.876	-52	.997	126	.069	61	.783	-17
3600.000	.861	-56	.987	122	.072	58	.776	-19
3800.000	.844	-60	.980	118	.074	56	.770	-20
4000.000	.823	-63	.964	115	.076	55	.763	-21
4200.000	.819	-66	.933	113	.077	53	.758	-22
4400.000	.808	-70	.925	109	.079	52	.754	-23
4600.000	.804	-73	.914	107	.081	50	.752	-25
4800.000	.802	-76	.906	104	.083	49	.752	-26
5000.000	.798	-79	.896	101	.085	47	.753	-27
5200.000	.798	-82	.894	98	.087	46	.759	-28
5400.000	.787	-85	.882	95	.090	44	.760	-29
5600.000	.772	-88	.875	91	.093	40	.758	-31
5800.000	.740	-91	.849	88	.094	35	.748	-32
6000.000	.693	-92	.809	85	.086	27	.734	-31
6200.000	.683	-91	.789	85	.071	32	.739	-30
6400.000	.679	-93	.790	84	.072	39	.741	-31
6600.000	.669	-96	.792	81	.078	40	.736	-32
6800.000	.655	-100	.784	79	.080	40	.725	-34
7000.000	.643	-103	.774	77	.081	39	.713	-35
7200.000	.632	-106	.773	75	.083	38	.705	-36
7400.000	.630	-109	.770	73	.084	37	.699	-38
7600.000	.629	-113	.764	71	.085	37	.703	-40
7800.000	.621	-116	.763	68	.086	35	.705	-41
8000.000	.616	-119	.763	66	.086	35	.707	-42
8200.000	.618	-123	.763	62	.089	33	.744	-43
8400.000	.600	-127	.757	59	.089	31	.750	-44
8600.000	.577	-131	.739	57	.088	29	.744	-45
8800.000	.553	-136	.731	54	.087	27	.733	-45
9000.000	.543	-140	.714	52	.085	27	.720	-46
9200.000	.546	-144	.693	50	.083	27	.702	-47
9400.000	.548	-148	.688	48	.083	26	.687	-48
9600.000	.550	-152	.681	47	.083	27	.678	-48
9800.000	.567	-157	.682	45	.084	27	.658	-49
10000.00	.591	-161	.681	43	.085	25	.648	-51
10200.00	.617	-163	.682	40	.085	24	.652	-55
10400.00	.637	-165	.681	37	.086	23	.662	-58
10600.00	.651	-165	.684	35	.086	22	.688	-61
10800.00	.637	-165	.675	31	.086	20	.725	-63
11000.00	.612	-164	.661	26	.086	17	.763	-66
11200.00	.560	-161	.641	22	.084	16	.810	-67
11400.00	.472	-157	.603	18	.082	13	.850	-66
11600.00	.450	-150	.529	18	.075	13	.812	-67
11800.00	.434	-148	.512	23	.074	17	.761	-63
12000.00	.418	-148	.524	27	.075	21	.737	-57
12200.00	.556	-164	.635	23	.085	21	.780	-60

12400.00	.473	-174	.632	19	.087	19	.745	-54
12600.00	.440	158	.604	14	.095	17	.690	-54
12800.00	.515	154	.595	12	.096	14	.634	-58
13000.00	.553	151	.593	8	.096	10	.610	-63
13200.00	.585	152	.583	4	.096	7	.607	-72
13400.00	.606	156	.569	2	.093	4	.635	-80
13600.00	.598	162	.545	-2	.091	2	.693	-87
13800.00	.566	169	.520	-4	.087	1	.750	-90
14000.00	.570	174	.492	-3	.084	3	.731	-90
14200.00	.582	174	.499	-0	.088	7	.720	-85
14400.00	.550	169	.528	-1	.094	7	.725	-80
14600.00	.501	160	.554	-3	.100	5	.744	-75
14800.00	.441	150	.570	-7	.104	2	.757	-71
15000.00	.415	138	.574	-11	.107	-1	.748	-70
15200.00	.421	128	.574	-15	.109	-3	.728	-70
15400.00	.439	122	.562	-19	.111	-5	.689	-72
15600.00	.462	117	.562	-22	.114	-8	.649	-76
15800.00	.486	115	.543	-26	.115	-10	.622	-81
16000.00	.502	113	.542	-28	.119	-13	.604	-86
16200.00	.498	110	.540	-31	.121	-14	.605	-90
16400.00	.495	108	.532	-34	.122	-17	.614	-93
16600.00	.489	106	.523	-36	.124	-20	.617	-96
16800.00	.490	103	.522	-37	.127	-21	.617	-99
17000.00	.502	98	.518	-41	.126	-24	.622	-99
17200.00	.508	91	.521	-44	.130	-26	.618	-99
17400.00	.519	85	.520	-47	.130	-28	.610	-100
17600.00	.536	81	.508	-50	.131	-29	.601	-101
17800.00	.551	78	.496	-52	.133	-31	.578	-104
18000.00	.559	76	.494	-55	.137	-32	.569	-107

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) *4 VDD=4V ID=31.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.930	-35	1.147	146	.034	73	.784	-7
2200.000	.919	-39	1.142	143	.037	71	.782	-9
2400.000	.912	-43	1.147	139	.040	70	.779	-10
2600.000	.898	-48	1.143	135	.043	68	.776	-11
2800.000	.891	-52	1.144	132	.046	66	.779	-12
3000.000	.876	-56	1.139	128	.048	64	.773	-13
3200.000	.857	-61	1.132	124	.050	62	.770	-15
3400.000	.842	-65	1.117	120	.052	60	.768	-16
3600.000	.823	-70	1.096	116	.053	58	.762	-17
3800.000	.809	-74	1.082	113	.055	56	.756	-18
4000.000	.785	-78	1.055	109	.056	54	.749	-20
4200.000	.783	-81	1.022	107	.056	53	.746	-21
4400.000	.776	-86	1.006	104	.057	52	.742	-22
4600.000	.770	-89	.988	101	.058	51	.740	-23
4800.000	.768	-93	.974	98	.059	50	.741	-24
5000.000	.765	-96	.955	95	.061	48	.743	-25
5200.000	.762	-99	.947	93	.061	47	.748	-26
5400.000	.749	-102	.929	90	.063	45	.751	-27
5600.000	.734	-106	.916	86	.064	41	.750	-29
5800.000	.699	-109	.886	83	.063	36	.742	-29
6000.000	.651	-111	.840	80	.055	25	.731	-29
6200.000	.639	-111	.818	80	.041	36	.735	-28
6400.000	.635	-113	.818	79	.044	49	.739	-29
6600.000	.629	-117	.816	76	.050	51	.735	-30
6800.000	.620	-121	.807	74	.051	50	.724	-31
7000.000	.611	-124	.795	72	.052	50	.713	-33
7200.000	.605	-128	.790	70	.054	49	.705	-34
7400.000	.606	-132	.786	68	.054	50	.699	-35
7600.000	.605	-136	.777	65	.054	50	.704	-37
7800.000	.598	-139	.777	63	.055	49	.707	-38
8000.000	.594	-143	.773	61	.055	50	.710	-39
8200.000	.595	-148	.766	57	.057	49	.750	-40
8400.000	.580	-152	.753	54	.057	48	.757	-41
8600.000	.563	-156	.736	51	.057	47	.753	-42
8800.000	.549	-161	.720	48	.056	47	.743	-42
9000.000	.550	-165	.700	46	.055	47	.731	-43
9200.000	.559	-169	.677	44	.054	48	.713	-45
9400.000	.570	-173	.665	42	.055	49	.697	-45
9600.000	.578	-176	.652	41	.056	51	.690	-45
9800.000	.599	180	.644	39	.057	50	.670	-46
10000.00	.625	177	.636	37	.058	50	.660	-48
10200.00	.646	176	.631	34	.059	49	.663	-52
10400.00	.658	175	.625	32	.060	49	.672	-54
10600.00	.660	176	.622	30	.060	48	.699	-58
10800.00	.634	176	.611	26	.061	47	.737	-60
11000.00	.600	177	.597	23	.062	46	.776	-62
11200.00	.538	179	.578	19	.061	44	.825	-64
11400.00	.444	-179	.547	16	.062	43	.870	-63
11600.00	.416	-173	.487	15	.058	42	.836	-64
11800.00	.408	-173	.473	20	.059	45	.786	-61
12000.00	.398	-178	.486	23	.060	46	.765	-55
12200.00	.533	170	.565	18	.066	45	.818	-56

12400.00	.483	158	.560	15	.066	44	.789	-52
12600.00	.495	134	.524	12	.071	42	.738	-53
12800.00	.573	134	.517	9	.072	40	.674	-57
13000.00	.611	133	.515	6	.072	37	.646	-62
13200.00	.633	136	.509	3	.072	34	.638	-70
13400.00	.640	141	.498	1	.072	33	.661	-78
13600.00	.620	146	.482	-2	.071	31	.713	-85
13800.00	.576	152	.464	-5	.070	29	.766	-88
14000.00	.573	155	.443	-4	.069	31	.745	-88
14200.00	.582	153	.449	-3	.073	33	.730	-83
14400.00	.544	145	.466	-4	.077	31	.736	-78
14600.00	.498	134	.477	-7	.080	29	.759	-73
14800.00	.461	122	.484	-10	.083	27	.776	-69
15000.00	.464	112	.486	-13	.086	24	.769	-68
15200.00	.488	105	.485	-17	.089	22	.751	-68
15400.00	.518	101	.476	-20	.092	19	.713	-70
15600.00	.545	98	.477	-23	.095	16	.671	-73
15800.00	.573	97	.462	-27	.097	13	.642	-78
16000.00	.584	95	.460	-29	.100	10	.619	-82
16200.00	.578	92	.455	-32	.101	7	.618	-86
16400.00	.571	90	.446	-35	.103	4	.624	-90
16600.00	.562	88	.438	-38	.105	1	.622	-93
16800.00	.565	85	.435	-38	.106	-2	.619	-95
17000.00	.577	80	.428	-42	.104	-5	.620	-95
17200.00	.585	74	.424	-46	.106	-7	.617	-95
17400.00	.597	70	.419	-48	.106	-8	.607	-95
17600.00	.615	67	.408	-51	.107	-9	.598	-96
17800.00	.628	65	.396	-52	.108	-11	.578	-98
18000.00	.632	63	.391	-55	.112	-12	.568	-100

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

OHR PREAMP [illegible]

[illegible] .00 MA (MEAS [illegible]) [illegible] ID=1[illegible]

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
[illegible]	.943	-30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-5
[illegible]	.932	-33	[illegible]	[illegible]	.049	[illegible]	[illegible]	-6
[illegible]	.924	-37	[illegible]	114	.052	[illegible]	.751	-7
[illegible]	.912	-40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.897	-44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.888	-48	[illegible]	131	.064	[illegible]	[illegible]	-10
[illegible]	.871	-52	[illegible]	130	[illegible]	65	.725	-12
[illegible]	.864	-55	[illegible]	127	.071	[illegible]	.721	-13
[illegible]	.849	-59	[illegible]	123	.074	61	.717	-15
[illegible]	.840	-63	[illegible]	120	.077	59	.712	-16
[illegible]	.827	-66	[illegible]	117	.079	57	.709	-18
[illegible]	.813	-70	[illegible]	[illegible]	.081	55	.707	-19
[illegible]	.805	-73	1.077	110	.084	53	.703	-20
4300.000	.791	-77	1.056	107	.085	52	.701	-21
[illegible]	.781	-80	1.047	105	.087	50	.697	-22
[illegible]	.765	-84	1.036	102	.088	48	.692	-24
[illegible]	.752	-87	1.025	99	.089	47	.690	-24
[illegible]	.737	-91	1.012	96	.092	45	.684	-25
[illegible]	.724	-94	.989	92	.093	42	.679	-26
[illegible]	.701	-98	[illegible]	89	.094	37	.664	-27
[illegible]	.665	-102	[illegible]	86	[illegible]	[illegible]	.653	-27
[illegible]	.648	-101	.893	86	.072	34	.661	-27
[illegible]	.671	-104	.909	85	.074	40	.673	-27
[illegible]	.669	-107	.908	83	.080	41	.673	-29
[illegible]	.667	-110	.904	80	.083	43	.672	-30
[illegible]	.664	-113	.892	77	.084	42	.677	-31
[illegible]	.655	-116	.888	75	.086	41	.683	-31
7400.000	.641	-119	.876	73	.086	40	.679	-32
[illegible]	.628	-122	.862	71	.086	40	.666	-32
[illegible]	.616	-125	.864	[illegible]	[illegible]	40	[illegible]	-33
[illegible]	.605	[illegible]	.854	[illegible]	.086	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-132	.852	64	.087	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-136	.843	62	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-139	.845	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-144	.837	57	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.597	-147	.823	54	[illegible]	[illegible]	.617	[illegible]
[illegible]	.592	-151	.813	51	[illegible]	[illegible]	.614	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	50	[illegible]	[illegible]	.612	[illegible]
[illegible]	[illegible]	-155	.791	47	[illegible]	[illegible]	.610	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	45	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.544	[illegible]	[illegible]	43	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	41	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	.532	171	.719	17	.096	22	.616	-66
[illegible]	.499	167	.682	13	.097	22	.633	-68
[illegible]	.460	156	.679	11	.098	20	.633	-66
[illegible]	.497	150	.670	8	.099	18	.620	-69
[illegible]	.502	145	.659	6	.100	18	.620	-70
[illegible]	.505	143	.644	2	.103	17	.644	-71
[illegible]	.489	141	.610	-0	.107	15	.670	-70
[illegible]	.482	139	.595	-1	.108	12	.680	-70
[illegible]	.510	135	.580	-3	.102	10	.645	-7[illegible]
[illegible]	.534	130	.577	-4	.103	8	.625	-76
[illegible]	.527	125	.587	-8	.107	9	.619	-7[illegible]
[illegible]	.524	122	.538	-10	.106	8	.621	-81
[illegible]	.532	115	.580	-14	.109	9	.626	-81
[illegible]	.526	108	.567	-17	.111	7	.638	-82
[illegible]	.521	103	.559	-18	.115	5	.634	-85
[illegible]	.514	104	.559	-20	.114	3	.616	-86
[illegible]	.512	101	.561	-23	.112	3	.604	-84
[illegible]	.522	95	.559	-26	.115	2	.589	-83
[illegible]	.532	90	.550	-28	.116	2	.580	-84
[illegible]	.549	86	.546	-30	.120	-1	.573	-86
[illegible]	.556	81	.546	-33	.121	-2	.560	-87
[illegible]	.572	76	.541	-30	.125	-4	.546	-87
[illegible]	.581	74	.520	[illegible]	[illegible]	-5	.531	-87
[illegible]	[illegible]	72	[illegible]	[illegible]	[illegible]	[illegible]	.515	[illegible]
[illegible]	.603	71	[illegible]	[illegible]	[illegible]	-[illegible]	[illegible]	[illegible]
[illegible]	.510	[illegible]	[illegible]	[illegible]	[illegible]	-1[illegible]	.434	[illegible]
[illegible]	.515	[illegible]	[illegible]	[illegible]	[illegible]	-1[illegible]	.383	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-1[illegible]	.327	-1[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-1[illegible]	.173	-1[illegible]

[illegible] ENT[illegible]: [illegible] .4[illegible] OUT [illegible]

[illegible] MAY 20 19[illegible]

ONR PREAMP FET CHARACTERIZATION

.30 VOLTS, .00 MA (MEAS 1) #5 VDD=4V ID=20.[illegible]MA

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	.932	-35	1.[illegible]	147	.039	74	.753	-5
2200.000	.920	-39	1.35[illegible]	144	.042	73	.748	-6
2400.000	.909	-43	1.[illegible]53	141	.045	71	.741	-6
2600.000	.898	-47	1.[illegible]4	137	.049	69	.735	-7
2800.000	.882	-51	1.[illegible]44	134	.052	67	.728	-9
3000.000	.868	-55	1.[illegible]	130	.055	66	.725	-10
3200.000	.851	-60	1.[illegible]1	127	.058	64	.715	-11
3400.000	.843	-64	1.231	123	.060	62	.711	-12
3600.000	.828	-68	1.2[illegible]	120	.062	60	.707	-14
3800.000	.820	-72	1.2[illegible]	116	.065	59	.704	-15
4000.000	.805	-76	1.1[illegible]	113	.066	57	.701	-17
4200.000	.790	-80	1.156	109	.068	55	.698	-18
4400.000	.779	-84	1.142	106	.069	54	.694	-19
4600.000	.768	-88	1.116	103	.070	52	.694	-20
4800.000	.757	-91	1.104	100	.071	51	.691	-21
5000.000	.741	-95	1.087	97	.072	49	.686	-22
5200.000	.728	-99	1.071	94	.073	47	.683	-23
5400.000	.714	-103	1.052	92	.075	46	.678	-24
5600.000	.702	-107	1.025	88	.076	43	.676	-25
5800.000	.682	-111	1.002	85	.075	38	.661	-26
6000.000	.640	-115	.952	82	.067	30	.649	-25
6200.000	.628	-114	.917	82	.052	38	.660	-25
6400.000	.649	-117	.931	82	.057	50	.671	-26
6600.000	.649	-120	.927	79	.063	50	.673	-28
6800.000	.650	-124	.920	76	.065	49	.674	-28
7000.000	.647	-127	.902	74	.066	49	.676	-29
7200.000	.637	-130	.896	71	.067	49	.682	-29
7400.000	.624	-133	.881	69	.068	48	.680	-30
7600.000	.613	-136	.868	67	.067	48	.670	-31
7800.000	.607	-140	.865	65	.068	49	.660	-31
8000.000	.599	-143	.851	63	.068	49	.650	-32
8200.000	.594	-147	.847	60	.070	49	.651	-32
8400.000	.595	-151	.839	58	.070	49	.642	-34
8600.000	.600	-155	.836	55	.070	49	.632	-35
8800.000	.603	-158	.824	53	.071	49	.634	-36
9000.000	.603	-161	.807	50	.072	49	.620	-38
9200.000	.596	-165	.798	48	.073	48	.632	-40
9400.000	.596	-168	.772	45	.074	48	.623	-42
9600.000	.601	-170	.771	44	.075	48	.623	-44
9800.000	.602	-171	.750	42	.076	47	.601	-45
[illegible]00.000	.602	-173	.737	40	.077	47	.607	-47
[illegible]00.000	.5[illegible]	-176	.724	[illegible]	.077	47	.603	-50
[illegible]00.[illegible]	.[illegible]8	-17[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12400.[illegible]	.562	150	.677	1[illegible]	.009	38	.63[illegible]	-64
[illegible]	.539	150	.633	19	[illegible]	36	.647	-66
[illegible]	.431	141	.640	6	.001	34	.654	-65
[illegible]	.450	131	.611	2	[illegible]	33	.634	-67
[illegible]	.416	121	.559	1	[illegible]	[illegible]	.634	-69
[illegible]	.474	12[illegible]	.560	3	[illegible]	31	[illegible]	-69
[illegible]	.535	126	.556	-1	.101	29	.693	-68
[illegible]	.522	131	.525	-2	.103	25	.702	-69
[illegible]	.512	132	.520	-2	.103	24	.661	-71
[illegible]	.533	125	.552	-3	.101	22	.6[illegible]4	-74
[illegible]	.551	114	.547	-[illegible]	.102	22	.633	-78
[illegible]	.573	110	.537	-11	.103	21	.612	-79
[illegible]	.505	106	.526	-14	.105	21	.645	-79
[illegible]	.563	101	.510	-17	.109	20	.657	-81
[illegible]	.551	96	.504	-18	.110	18	.655	-[illegible]
[illegible]	.556	93	.519	-20	.113	14	.637	-85
[illegible]	.568	91	.510	-23	.110	14	.624	-83
[illegible]	.574	88	.507	-26	.112	12	.606	-82
[illegible]	.578	82	.501	-28	.114	11	.597	-83
[illegible]	.594	76	.495	-31	.116	9	.533	-85
[illegible]	.611	73	.491	-33	.117	7	.530	-86
[illegible]	.631	70	.485	-35	.120	5	.567	-86
[illegible]	.600	[illegible]	.47[illegible]	-3[illegible]	.123	5	.552	-86
[illegible]	.5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	.5[illegible]	-[illegible]
[illegible]	.641	[illegible]	[illegible]	[illegible]	[illegible]	-1	.532	-[illegible]
[illegible]	.5[illegible]	[illegible]	.45[illegible]	[illegible]	[illegible]	[illegible]	.5[illegible]	-[illegible]
[illegible]	.507	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-[illegible]
[illegible]	.[illegible]3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.139	-[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-[illegible]	[illegible]	-1[illegible]

[illegible]

ONR PREAMP FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #5 VDD-4V ID=12.2MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.945	-29	1.077	151	.045	75	.773	-6
2200.000	.935	-32	1.090	147	.049	73	.769	-6
2400.000	.927	-35	1.085	144	.053	72	.762	-7
2600.000	.916	-39	1.090	141	.057	70	.756	-8
2800.000	.902	-42	1.088	138	.062	68	.749	-9
3000.000	.891	-46	1.091	135	.066	67	.746	-10
3200.000	.877	-50	1.087	131	.069	65	.737	-12
3400.000	.871	-53	1.084	128	.072	63	.733	-13
3600.000	.856	-57	1.077	124	.076	61	.728	-15
3800.000	.846	-60	1.080	121	.079	59	.723	-16
4000.000	.833	-64	1.068	118	.081	57	.720	-18
4200.000	.820	-67	1.052	114	.084	55	.719	-19
4400.000	.811	-71	1.043	111	.086	53	.715	-20
4600.000	.795	-74	1.025	108	.087	51	.713	-21
4800.000	.786	-78	1.016	105	.089	50	.708	-23
5000.000	.771	-81	1.007	103	.091	48	.703	-24
5200.000	.758	-84	.996	100	.092	46	.701	-25
5400.000	.744	-88	.985	97	.094	45	.694	-25
5600.000	.729	-91	.965	93	.096	41	.698	-26
5800.000	.706	-95	.948	90	.097	37	.675	-27
6000.000	.671	-98	.904	87	.092	30	.663	-27
6200.000	.656	-98	.871	87	.074	33	.672	-27
6400.000	.676	-100	.889	87	.077	42	.683	-28
6600.000	.672	-104	.891	84	.083	43	.682	-29
6800.000	.671	-107	.886	81	.086	42	.682	-30
7000.000	.670	-110	.874	78	.087	41	.686	-31
7200.000	.660	-113	.871	76	.089	40	.693	-31
7400.000	.645	-116	.862	74	.090	39	.688	-32
7600.000	.631	-119	.848	72	.089	39	.676	-33
7800.000	.620	-122	.848	70	.088	39	.665	-33
8000.000	.612	-125	[illegible]	68	.089	38	.661	-34
8200.000	.605	-128	.838	65	.090	37	.658	-35
8400.000	.598	-132	.832	63	.091	37	.647	-35
8600.000	.598	-136	.834	60	.091	36	.634	-36
8800.000	.598	-140	.827	58	.092	36	.636	-38
9000.000	.597	-143	.814	55	.092	35	.633	-40
9200.000	.588	-146	.806	52	.092	34	.628	-42
9400.000	.583	-150	.791	50	.092	33	.621	-44
[illegible]	.588	-153	.782	48	.093	32	.621	-46
[illegible]	.590	-155	.774	46	.093	31	.630	-49
[illegible]	.593	-156	.759	44	.093	30	.631	-51
[illegible]	.582	-159	.745	42	.094	30	.626	-52
[illegible]	.574	-160	.731	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-162	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]						

12400.00	.497	172	.697	17	.101	19	.609	-68
12600.00	.494	169	.665	15	.098	17	.619	-74
12800.00	.460	162	.665	12	.097	15	.638	-72
13000.00	.457	157	.653	9	.098	15	.640	-70
13200.00	.437	152	.606	8	.101	13	.606	-70
13[illegible]00.00	.460	147	.6[illegible]6	5	.099	10	.515	-73
13[illegible]00.00	.481	145	.615	2	.096	13	.430	-71
13[illegible]00.00	.475	146	.5[illegible]6	0	.105	13	.536	-71
14[illegible]00.00	.475	143	.579	-1	.108	9	.661	-74
14[illegible]00.00	.485	137	.574	-2	.102	7	.648	-72
14[illegible]00.00	.497	129	.573	-6	.105	9	.612	-71
1[illegible]00.00	.516	125	.559	-9	.108	9	.597	-75
1[illegible]00.00	.527	121	.572	-12	.112	7	.617	-80
1[illegible]00.00	.512	115	.559	-15	.114	6	.635	-83
1[illegible]00.00	.503	110	.553	-16	.117	5	.656	-82
1[illegible]00.00	.502	109	.560	-18	.117	2	.621	-82
15[illegible]00.00	.508	106	.563	-21	.116	1	.601	-82
15[illegible]00.00	.512	102	.560	-23	.113	-1	.592	-83
1[illegible]00.00	.510	96	.558	-26	.118	-2	.596	-84
16200.00	.526	90	.554	-28	.121	-3	.598	-83
16400.00	.540	85	.554	-31	.123	-5	.565	-84
1[illegible]00.00	.553	80	.547	-34	.127	-7	.547	-86
[illegible]	.562	78	.5[illegible]5	-3[illegible]	.1[illegible]	-8	.542	-88
[illegible]	.573	75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.584	73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.6[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ENT[illegible]: IN= 5.40, [illegible]UT: [illegible]

PAGE 1: 1 MAY 20 19[illegible]

ONR PREAMP FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #5 VDD=4V ID=9.15MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.947	-27	1.009	151	.046	75	.791	-6
2200.000	.939	-31	1.012	148	.051	74	.786	-6
2400.000	.929	-34	1.018	144	.055	72	.780	-7
2600.000	.919	-37	1.024	141	.060	70	.774	-8
2800.000	.905	-40	1.023	138	.064	69	.767	-9
3000.000	.896	-44	1.026	135	.068	67	.764	-11
3200.000	.882	-47	1.024	131	.072	65	.755	-12
3400.000	.877	-51	1.020	128	.076	63	.751	-13
3600.000	.861	-54	1.016	125	.079	61	.746	-15
3800.000	.852	-59	1.021	122	.082	59	.742	-16
4200.000	.839	-61	1.012	119	.084	58	.739	-18
4200.000	.824	-64	.994	115	.088	55	.736	-19
4400.000	.815	-68	.987	112	.090	53	.732	-21
4600.000	.800	-71	.971	108	.092	52	.731	-22
4800.000	.789	-74	.955	106	.094	50	.726	-23
5000.000	.775	-78	.956	103	.096	48	.721	-24
5200.000	.764	-81	.948	100	.097	46	.719	-25
5400.000	.751	-84	.939	97	.100	45	.712	-26
5600.000	.735	-88	.919	94	.102	41	.708	-26
5800.000	.714	-92	.916	90	.104	37	.693	-28
6000.000	.679	-95	.885	87	.099	30	.679	-28
6200.000	.662	-94	.831	88	.079	34	.691	-27
6400.000	.682	-97	.852	87	.085	41	.700	-28
6600.000	.679	-100	.854	84	.089	41	.699	-30
6800.000	.677	-103	.851	81	.092	40	.698	-30
7000.000	.675	-106	.839	78	.093	39	.704	-32
7200.000	.667	-109	.839	76	.095	39	.710	-32
7400.000	.651	-112	.829	74	.096	38	.707	-32
7600.000	.637	-115	.819	72	.095	37	.694	-33
7800.000	.627	-118	.813	70	.095	37	.683	-34
8000.000	.617	-121	.810	67	.096	35	.677	-35
8200.000	.609	-123	.811	65	.097	35	.675	-35
8400.000	.602	-127	.805	63	.097	34	.663	-36
8600.000	.602	-131	.800	60	.097	34	.651	-37
8800.000	.601	-135	.792	58	.099	33	.652	-39
9000.000	.598	-138	.780	55	.099	32	.658	-41
9200.000	.588	-142	.784	52	.099	31	.645	-43
9400.000	.583	-146	.771	50	.099	30	.638	-45
9600.000	.588	-148	.752	48	.099	28	.636	-47
9800.000	.591	-150	.745	45	.099	27	.647	-50
10000.00	.592	-152	.730	43	.097	26	.650	-51
10200.00	.581	-154	.720	41	.099	25	.645	-52
[illegible]	.577	-156	[illegible]	[illegible]	[illegible]	[illegible]	.612	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12400.00	.504	173	.683	15	.109	14	.534	-69
12600.00	.504	173	.640	13	.096	13	.517	-76
12800.00	.455	169	.645	11	.097	14	.599	-71
13000.00	.404	167	.616	6	.100	14	.624	-71
13200.00	.350	165	.587	8	.100	12	.654	-69
13400.00	.406	156	.616	7	.105	12	.640	-65
13600.00	.463	150	.619	2	.111	11	.655	-64
13800.00	.475	151	.579	-0	.116	7	.677	-69
14000.00	.474	151	.579	-1	.114	4	.671	-74
14200.00	.475	145	.592	-2	.111	2	.663	-75
14400.00	.479	135	.591	-7	.112	4	.646	-76
14600.00	.500	129	.584	-9	.114	3	.636	-79
14800.00	.519	125	.577	-13	.117	2	.646	-81
15000.00	.505	120	.559	-16	.120	1	.672	-84
15200.00	.490	115	.551	-17	.123	-0	.673	-84
15400.00	.485	113	.553	-19	.122	-3	.645	-84
15600.00	.492	110	.560	-22	.122	-4	.624	-84
15800.00	.500	106	.561	-24	.123	-6	.609	-84
16000.00	.495	100	.557	-27	.124	-7	.609	-84
16200.00	.507	94	.554	-30	.126	-9	.602	-85
16400.00	.520	88	.553	-32	.128	-11	.578	-86
16600.00	.541	84	.547	-35	.130	-13	.561	-88
[illegible]	.546	81	[illegible]	[illegible]	.132	-14	.553	-90
[illegible]	.552	78	[illegible]	[illegible]	[illegible]	[illegible]	.540	[illegible]
[illegible]	.565	76	[illegible]	[illegible]	[illegible]	[illegible]	.533	[illegible]
[illegible]	.583	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.520	[illegible]
[illegible]	.595	[illegible]	[illegible]	[illegible]	.131	[illegible]	.510	-100
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.511	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.513	[illegible]

[illegible] ENT(CM): IN= 5.40, OUT= [illegible]

MAY 29 198[illegible]

ONR PREAMP FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #3 VDD=4V ID=6.1[illegible]

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	.951	-26	.916	151	.040	76	.816	-6
2200.000	.942	-28	.932	148	.053	74	.813	-6
2400.000	.934	-31	.928	145	.058	72	.806	-7
2600.000	.924	-34	.936	142	.063	71	.799	-8
2800.000	.911	-38	.935	139	.067	69	.792	-10
3000.000	.903	-41	.941	136	.072	67	.792	-11
3200.000	.889	-44	.939	132	.076	65	.783	-12
3400.000	.884	-47	.940	129	.080	63	.778	-13
3600.000	.869	-51	.935	125	.084	61	.774	-15
3800.000	.860	-54	.911	122	.087	60	.770	-17
4000.000	.849	-57	.935	119	.090	58	.768	-18
4200.000	.836	-60	.920	116	.093	56	.764	-19
4400.000	.826	-63	.914	112	.096	54	.758	-21
4600.000	.810	-67	.902	109	.098	52	.756	-22
4800.000	.800	-70	.898	106	.100	50	.752	-23
5000.000	.788	-73	.891	104	.102	48	.748	-24
5200.000	.775	-76	.884	101	.104	47	.745	-25
5400.000	.761	-79	.878	98	.107	45	.737	-26
5600.000	.747	-83	.862	94	.110	41	.734	-27
5800.000	.724	-86	.849	91	.111	38	.721	-28
6000.000	.691	-89	.814	88	.107	31	.707	-28
6200.000	.677	-89	.783	88	.089	32	.715	-27
6400.000	.696	-91	.801	87	.092	40	.724	-28
6600.000	.692	-94	.804	84	.097	40	.724	-30
6800.000	.689	-98	.805	82	.100	39	.726	-31
7000.000	.689	-100	.795	79	.102	38	.730	-31
7200.000	.679	-103	.795	76	.104	37	.734	-32
7400.000	.663	-106	.788	74	.105	36	.730	-33
7600.000	.648	-108	.773	72	.104	35	.718	-34
7800.000	.637	-111	.778	70	.103	35	.709	-34
8000.000	.628	-114	.771	68	.104	34	.703	-34
8200.000	.619	-117	.774	65	.106	33	.699	-35
8400.000	.609	-120	.771	63	.106	32	.689	-37
8600.000	.607	-124	.774	61	.106	32	.679	-38
8800.000	.606	-128	.770	58	.108	31	.682	-39
9000.000	.604	-131	.760	55	.108	29	.675	-40
9200.000	.592	-135	.755	53	.109	28	.667	-43
9400.000	.585	-139	.743	50	.109	26	.664	[illegible]
9600.000	.581	-141	.736	48	.107	26	.658	-47
[illegible]	.570	-144	.720	47	.100	25	.648	-49
[illegible]	.565	-145	.716	43	.100	23	.672	-51
[illegible]	.552	-147	[illegible]	41	.10[illegible]	22	[illegible]	[illegible]
[illegible]	[illegible]	-150	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12400.00	.449	-177	.648	16	.110	12	.670	-67
12600.00	.467	-178	.624	14	.109	10	.683	-69
12800.00	.450	177	.634	11	.110	7	.686	-68
13000.00	.459	174	.617	9	.111	6	.667	-70
13200.00	.480	172	.610	8	.111	6	.667	-72
13400.00	.440	165	.610	5	.115	5	.696	-72
13600.00	.456	159	.696	1	.119	3	.728	-71
13800.00	.457	158	.580	-1	.120	-0	.738	-72
14000.00	.464	156	.566	-2	.119	-2	.700	-74
14200.00	.466	151	.601	-4	.115	-3	.678	-77
14400.00	.468	143	.581	-7	.117	-3	.674	-81
14600.00	.482	137	.570	-10	.117	-3	.676	-82
14800.00	.501	132	.572	-10	.119	-3	.681	-82
15000.00	.489	127	.564	-17	.122	-3	.694	-84
15200.00	.475	122	.543	-18	.127	-5	.692	-86
15400.00	.469	121	.557	-20	.125	-9	.673	-88
15600.00	.470	117	.556	-23	.123	-8	.657	-86
15800.00	.477	113	.558	-25	.125	-10	.637	-85
16000.00	.473	107	.555	-28	.127	-10	.634	-86
16200.00	.482	101	.551	-30	.130	-13	.625	-88
16400.00	.494	95	.550	-30	.131	-15	.611	-89
16600.00	.511	89	.549	-36	.133	-17	.598	-89
16800.00	.520	86	[illegible]	[illegible]	.135	-17	.564	-90
[illegible]	.520	83	[illegible]	[illegible]	.141	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.142	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	78	[illegible]	[illegible]	.111	[illegible]	.532	[illegible]
[illegible]	.572	75	[illegible]	[illegible]	[illegible]	[illegible]	.512	[illegible]
[illegible]	[illegible]	73	[illegible]	[illegible]	.147	[illegible]	.507	-104
[illegible]	[illegible]	72	[illegible]	[illegible]	[illegible]	[illegible]	.500	[illegible]

[illegible] INT[illegible]: IN= 5.40, OUT= [illegible]

ONR PA #21 FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #1 VDD=4V ID=65.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.928	-29	1.794	152	.019	83	.809	-6
2200.000	.922	-32	1.787	149	.021	82	.811	-8
2400.000	.916	-35	1.789	146	.023	82	.809	-8
2600.000	.904	-38	1.780	144	.024	81	.808	-9
2800.000	.897	-41	1.787	141	.026	81	.811	-9
3000.000	.884	-44	1.783	138	.027	80	.805	-10
3200.000	.874	-47	1.791	135	.028	80	.807	-10
3400.000	.863	-49	1.788	133	.029	80	.805	-11
3600.000	.848	-52	1.781	129	.030	79	.801	-11
3800.000	.834	-54	1.793	126	.030	79	.800	-11
4000.000	.814	-57	1.787	123	.031	79	.793	-11
4200.000	.803	-60	1.762	121	.032	80	.789	-12
4400.000	.785	-64	1.769	117	.033	80	.784	-12
4600.000	.772	-67	1.748	114	.033	81	.778	-12
4800.000	.761	-71	1.759	112	.035	81	.777	-13
5000.000	.746	-75	1.739	108	.035	81	.776	-14
5200.000	.731	-79	1.745	105	.037	81	.772	-15
5400.000	.714	-83	1.721	102	.037	80	.769	-16
5600.000	.696	-88	1.719	98	.038	76	.765	-17
5800.000	.670	-93	1.670	94	.037	69	.754	-19
6000.000	.616	-97	1.603	90	.027	55	.734	-19
6200.000	.588	-96	1.524	90	.015	97	.734	-18
6400.000	.602	-98	1.527	89	.028	120	.752	-19
6600.000	.609	-102	1.552	87	.036	114	.760	-21
6800.000	.604	-107	1.540	84	.039	111	.759	-23
7000.000	.593	-111	1.513	81	.042	111	.755	-24
7200.000	.584	-114	1.503	78	.044	110	.754	-26
7400.000	.577	-118	1.486	76	.046	111	.752	-27
7600.000	.572	-121	1.461	74	.049	113	.754	-29
7800.000	.565	-125	1.447	71	.052	113	.758	-30
8000.000	.563	-128	1.432	70	.055	113	.762	-31
8200.000	.559	-131	1.420	66	.059	113	.770	-32
8400.000	.551	-134	1.414	65	.062	112	.778	-33
8600.000	.542	-138	1.398	62	.064	112	.776	-34
8800.000	.532	-142	1.388	60	.067	111	.773	-36
9000.000	.526	-145	1.375	57	.070	111	.778	-37
9200.000	.522	-149	1.359	54	.073	111	.771	-38
9400.000	.518	-152	1.337	52	.077	111	.772	-39
9600.000	.517	-156	1.332	49	.080	110	.774	-40
9800.000	.515	-160	1.304	47	.084	109	.770	-41
10000.00	.515	-163	1.288	44	.087	108	.773	-42
10200.00	.515	-167	1.268	42	.091	107	.778	-44
10400.00	.515	-170	1.253	40	.095	106	.782	-46
10600.00	.512	-172	1.246	38	.098	104	.785	-48
10800.00	.503	-175	1.218	35	.101	103	.796	-50
11000.00	.497	-178	1.221	33	.105	100	.804	-51
11200.00	.480	180	1.183	31	.106	100	.800	-53
11400.00	.469	176	1.133	28	.110	97	.813	-54
11600.00	.468	174	1.173	26	.112	97	.813	-55
11800.30	.449	170	1.175	24	.116	95	.815	-56
12000.00	.441	166	1.159	21	.116	94	.814	-56
12200.00	.434	160	1.167	19	.120	92	.822	-57

12400.00	.420	155	1.162	16	.122	91	.815	-57
12600.00	.417	148	1.147	12	.125	90	.822	-56
12800.00	.415	142	1.154	9	.128	88	.826	-56
13000.00	.414	135	1.104	5	.133	87	.833	-56
13200.00	.414	129	1.103	3	.138	85	.841	-57
13400.00	.416	124	1.065	0	.142	83	.848	-58
13600.00	.424	118	1.054	-2	.145	80	.852	-60
13800.00	.435	113	1.038	-5	.149	77	.859	-62
14000.00	.448	109	1.025	-9	.151	75	.859	-65
14200.00	.457	106	1.003	-11	.149	71	.846	-68
14400.00	.461	103	.975	-16	.146	69	.828	-72
14600.00	.461	100	.935	-19	.136	69	.801	-77
14800.00	.445	100	.830	-24	.122	78	.723	-84
15000.00	.484	105	.732	-12	.178	91	.562	-78
15200.00	.535	99	.890	-12	.217	75	.676	-68
15400.00	.528	93	.907	-18	.220	65	.744	-71
15600.00	.518	87	.934	-20	.212	59	.777	-75
15800.00	.508	83	.918	-26	.216	57	.809	-77
16000.00	.503	78	.921	-27	.215	52	.827	-79
16200.00	.500	72	.929	-32	.221	52	.846	-81
16400.00	.505	68	.906	-34	.224	47	.857	-82
16600.00	.516	63	.907	-38	.232	45	.852	-84
16800.00	.541	59	.903	-39	.239	41	.840	-86
17000.00	.569	55	.892	-43	.242	38	.820	-88
17200.00	.601	52	.878	-47	.252	34	.789	-90
17400.30	.630	50	.903	-48	.249	30	.734	-93
17600.00	.650	48	.890	-54	.254	29	.701	-96
17800.00	.646	45	.870	-55	.256	24	.659	-100
18000.00	.642	44	.908	-61	.262	25	.636	-103

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

8 OCT 80

S-PARAMETER FOR ONR-20 DEVICES
DEVICE ONR-20-1

.00 VOLTS, .00 MA (MEAS 1) VD=4 ID=55 VG=-2.7

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.929	-29	1.835	151	.020	81	.813	-8
2200.000	.922	-33	1.823	149	.021	80	.815	-9
2400.000	.916	-35	1.819	146	.023	80	.814	-10
2600.000	.906	-38	1.805	143	.024	79	.814	-11
2800.000	.898	-41	1.806	140	.026	79	.817	-11
3000.000	.885	-43	1.798	138	.027	79	.811	-12
3200.000	.874	-46	1.797	135	.028	78	.813	-12
3400.000	.863	-48	1.790	133	.029	78	.812	-12
3600.000	.849	-50	1.776	130	.029	78	.809	-12
3800.000	.835	-53	1.781	127	.030	78	.808	-12
4000.000	.815	-55	1.770	124	.031	78	.803	-12
4200.000	.802	-58	1.736	122	.031	79	.798	-12
4400.000	.783	-61	1.741	119	.032	80	.796	-12
4600.000	.771	-64	1.717	116	.032	81	.791	-13
4800.000	.760	-67	1.727	114	.034	82	.792	-13
5000.000	.744	-70	1.709	111	.034	83	.793	-13
5200.000	.730	-74	1.718	109	.035	85	.791	-14
5400.000	.711	-77	1.699	106	.036	86	.790	-15
5600.000	.695	-81	1.703	102	.037	86	.792	-15
5800.000	.678	-85	1.674	100	.038	88	.789	-16
6000.000	.660	-88	1.675	97	.039	88	.791	-17
6200.000	.641	-92	1.652	95	.040	89	.787	-18
6400.000	.622	-96	1.624	92	.041	90	.780	-19
6600.000	.606	-100	1.622	89	.042	89	.776	-20
6800.000	.582	-105	1.589	85	.038	95	.769	-20
7000.000	.561	-106	1.544	85	.044	99	.773	-21
7200.000	.559	-111	1.559	82	.047	98	.772	-22
7400.000	.552	-115	1.552	79	.049	99	.768	-23
7600.000	.545	-119	1.532	77	.051	99	.769	-24
7800.000	.536	-124	1.524	74	.053	99	.772	-25
8000.000	.531	-128	1.511	72	.055	99	.770	-26
8200.000	.523	-133	1.495	69	.057	98	.775	-27
8400.000	.511	-138	1.486	67	.058	96	.778	-28
8600.000	.487	-143	1.441	63	.054	94	.763	-30
8800.000	.463	-145	1.403	62	.047	105	.749	-29
9000.000	.472	-148	1.421	61	.062	112	.779	-29
9200.000	.479	-153	1.421	58	.069	108	.777	-31
9400.000	.484	-158	1.400	55	.073	106	.774	-33
9600.000	.486	-162	1.397	52	.076	103	.773	-34
9800.000	.489	-167	1.360	49	.078	102	.765	-36
10000.00	.496	-171	1.341	46	.078	99	.758	-37
10200.00	.498	-175	1.313	44	.071	98	.740	-39
10400.00	.504	-179	1.293	41	.078	111	.758	-38
10600.00	.502	179	1.274	40	.091	107	.779	-40
10800.00	.485	176	1.216	38	.096	104	.792	-43
11000.00	.486	175	1.239	37	.099	100	.801	-45
11200.00	.476	173	1.203	34	.101	100	.793	-47
11400.00	.476	169	1.209	32	.104	96	.806	-49
11600.00	.494	166	1.196	29	.106	96	.806	-50
11800.00	.472	162	1.193	27	.110	93	.809	-51
12000.00	.469	158	1.170	25	.109	93	.803	-51
12200.00	.470	154	1.175	22	.114	91	.814	-52

12400.00	.465	149	1.165	20	.116	91	.808	-52
12600.00	.470	143	1.148	17	.118	90	.812	-51
12800.00	.474	138	1.154	14	.121	89	.816	-51
13000.00	.478	133	1.106	10	.126	88	.820	-51
13200.00	.481	128	1.103	9	.131	86	.828	-51
13400.00	.486	124	1.067	6	.136	85	.832	-52
13600.00	.498	120	1.054	4	.139	83	.837	-53
13800.00	.511	117	1.041	3	.145	81	.838	-55
14000.00	.528	114	1.029	-1	.150	79	.840	-57
14200.00	.540	112	1.009	-2	.153	76	.827	-59
14400.00	.552	109	.993	-6	.157	74	.812	-62
14600.00	.567	108	.979	-7	.160	72	.800	-64
14800.00	.578	106	.968	-11	.163	70	.786	-67
15000.00	.585	105	.943	-11	.167	67	.774	-70
15200.00	.587	103	.941	-14	.169	66	.778	-72
15400.00	.575	101	.904	-16	.177	64	.777	-73
15600.00	.569	98	.924	-16	.177	61	.785	-75
15800.00	.564	95	.904	-21	.184	60	.802	-77
16000.00	.552	92	.909	-21	.188	56	.812	-78
16200.00	.545	88	.916	-26	.194	57	.827	-80
16400.00	.544	84	.890	-28	.201	53	.834	-81
16600.00	.546	79	.883	-32	.209	52	.831	-83
16800.00	.559	75	.867	-33	.219	49	.822	-84
17000.00	.582	72	.849	-36	.226	46	.805	-86
17200.00	.606	69	.820	-38	.239	43	.776	-88
17400.00	.633	66	.848	-39	.241	39	.731	-91
17600.00	.652	64	.826	-43	.250	38	.701	-94
17800.00	.654	61	.815	-43	.260	33	.669	-97
18000.00	.646	59	.855	-48	.269	33	.650	-100

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

8 OCT 80

S-PARAMETER FOR ONR-20 DEVICES
DEVICE ONR-20-2

.00 VOLTS, .00 MA (MEAS 1) VD=4 ID=60 VG=-2.7

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.930	-30	1.806	152	.018	84	.804	-6
2200.000	.924	-33	1.794	149	.019	83	.804	-8
2400.000	.918	-36	1.792	147	.021	82	.804	-8
2600.000	.907	-39	1.779	144	.022	82	.804	-9
2800.000	.900	-41	1.781	141	.023	82	.807	-9
3000.000	.886	-44	1.771	139	.024	82	.801	-10
3200.000	.877	-46	1.775	136	.026	82	.803	-10
3400.000	.867	-48	1.768	133	.026	82	.803	-11
3600.000	.852	-50	1.758	130	.027	82	.800	-11
3800.000	.839	-53	1.766	128	.028	83	.799	-10
4000.000	.821	-55	1.761	125	.028	83	.795	-11
4200.000	.806	-57	1.727	123	.029	85	.792	-11
4400.000	.790	-60	1.735	120	.030	86	.789	-11
4600.000	.777	-63	1.713	117	.030	87	.785	-11
4800.000	.765	-67	1.725	115	.031	89	.786	-11
5000.000	.750	-70	1.707	112	.032	90	.786	-12
5200.000	.737	-73	1.716	109	.033	92	.784	-13
5400.000	.719	-77	1.696	106	.034	93	.784	-13
5600.000	.703	-81	1.701	103	.035	94	.787	-14
5800.000	.685	-84	1.669	100	.037	96	.786	-15
6000.000	.668	-88	1.671	97	.038	97	.786	-16
6200.000	.649	-91	1.647	95	.039	98	.782	-16
6400.000	.630	-95	1.621	92	.041	99	.777	-18
6600.000	.615	-99	1.619	90	.043	101	.775	-18
6800.000	.600	-104	1.599	87	.044	102	.773	-19
7000.000	.582	-107	1.563	84	.046	102	.767	-20
7200.000	.570	-111	1.556	82	.048	103	.765	-21
7400.000	.562	-115	1.545	79	.051	104	.761	-22
7600.000	.556	-119	1.520	77	.053	105	.763	-23
7800.000	.548	-123	1.510	74	.055	105	.767	-24
8000.000	.542	-127	1.492	72	.058	105	.767	-24
8200.000	.535	-130	1.476	69	.060	104	.776	-25
8400.000	.525	-135	1.467	67	.063	103	.780	-26
8600.000	.513	-139	1.450	64	.061	101	.768	-27
8800.000	.498	-144	1.428	62	.065	106	.760	-26
9000.000	.479	-149	1.392	59	.062	103	.780	-27
9200.000	.445	-152	1.331	57	.068	107	.775	-28
9400.000	.438	-151	1.318	57	.077	106	.772	-29
9600.000	.450	-153	1.349	56	.078	104	.772	-30
9800.000	.462	-157	1.348	53	.076	102	.763	-31
10000.00	.467	-161	1.341	50	.069	106	.754	-33
10200.00	.467	-164	1.325	48	.082	119	.754	-33
10400.00	.469	-167	1.316	45	.095	107	.757	-35
10600.00	.465	-169	1.311	44	.100	104	.784	-36
10800.00	.457	-172	1.289	41	.104	103	.794	-38
11000.00	.447	-174	1.299	39	.108	100	.803	-40
11200.00	.425	-176	1.258	36	.111	103	.797	-41
11400.00	.411	-180	1.266	34	.113	99	.812	-43
11600.00	.406	178	1.264	31	.118	98	.812	[illegible]
11800.00	.382	174	1.269	29	.126	96	.812	-46
12000.00	.365	169	1.255	27	.125	95	.808	-46
12200.00	.352	163	1.270	24	.131	93	.819	-47

12400.00	.333	157	1.268	21	.134	92	.813	-47
12600.00	.322	150	1.257	18	.137	90	.825	-46
12800.00	.314	141	1.269	15	.142	89	.829	-45
13000.00	.312	132	1.225	10	.148	88	.836	-45
13200.00	.312	124	1.225	9	.156	86	.845	-46
13400.00	.317	117	1.191	6	.163	84	.855	-47
13600.00	.329	109	1.183	3	.169	81	.862	-48
13800.00	.346	103	1.173	1	.177	78	.870	-51
14000.00	.365	98	1.175	-3	.186	75	.875	-53
14200.00	.382	93	1.154	-4	.190	71	.865	-56
14400.00	.398	89	1.148	-9	.196	68	.849	-59
14600.00	.411	86	1.135	-11	.199	65	.840	-62
14800.00	.421	82	1.122	-15	.202	62	.827	-65
15000.00	.427	78	1.092	-17	.208	59	.813	-68
15200.00	.427	74	1.081	-21	.211	57	.816	-70
15400.00	.421	69	1.032	-24	.219	53	.818	-73
15600.00	.419	64	1.040	-24	.219	51	.825	-75
15800.00	.418	59	1.014	-29	.227	49	.842	-77
16000.00	.423	53	1.009	-30	.229	45	.850	-79
16200.00	.431	47	1.017	-34	.242	45	.867	-80
16400.00	.450	42	.983	-36	.246	41	.876	-82
16600.00	.473	36	.982	-40	.259	38	.875	-83
16800.00	.507	32	.972	-41	.270	35	.866	-85
17000.00	.538	28	.953	-45	.275	31	.848	-87
17200.00	.568	25	.923	-49	.283	27	.818	-89
17400.00	.586	22	.942	-51	.284	24	.769	-92
17600.00	.595	19	.907	-56	.296	22	.743	-94
17800.00	.575	14	.868	-57	.300	19	.707	-97
18000.00	.559	11	.887	-62	.324	18	.697	-100

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

 8 OCT 80

S-PARAMETER FOR ONR-20 DEVICES
DEVICE ONR-20-3

.00 VOLTS, .00 MA (MEAS 1) VD=4 ID=60 VG=-2.7

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.929	-27	1.853	154	.019	85	.804	-5
2200.000	.922	-31	1.847	151	.020	84	.805	-6
2400.000	.915	-34	1.853	148	.022	84	.804	-7
2600.000	.904	-37	1.846	146	.023	83	.804	-7
2800.000	.896	-39	1.855	143	.025	81	.806	-8
3000.000	.881	-42	1.851	140	.025	83	.798	-8
3200.000	.870	-45	1.853	137	.027	83	.801	-9
3400.000	.858	-48	1.852	134	.028	83	.800	-9
3600.000	.843	-50	1.841	131	.028	83	.797	-9
3800.000	.828	-53	1.850	128	.029	83	.797	-9
4000.000	.808	-57	1.842	125	.030	84	.791	-9
4200.000	.794	-59	1.803	123	.031	84	.787	-9
4400.000	.775	-63	1.807	119	.031	84	.784	-9
4600.000	.762	-66	1.779	117	.030	83	.774	-10
4800.000	.750	-70	1.787	114	.032	90	.779	-10
5000.000	.734	-74	1.763	111	.033	91	.780	-10
5200.000	.694	-77	1.715	108	.034	92	.778	-11
5400.000	.700	-80	1.712	106	.035	94	.779	-12
5600.000	.691	-84	1.719	103	.036	94	.782	-12
5800.000	.677	-88	1.683	100	.038	96	.781	-13
6000.000	.661	-92	1.677	97	.039	97	.783	-14
6200.000	.639	-96	1.641	95	.040	99	.779	-15
6400.000	.625	-98	1.605	93	.041	100	.773	-16
6600.000	.616	-102	1.606	91	.043	102	.771	-16
6800.000	.604	-106	1.586	88	.043	104	.768	-17
7000.000	.588	-109	1.549	86	.046	105	.764	-18
7200.000	.576	-112	1.541	83	.049	106	.761	-19
7400.000	.570	-115	1.531	81	.051	107	.757	-20
7600.000	.564	-119	1.509	79	.054	108	.760	-21
7800.000	.555	-122	1.500	77	.056	109	.766	-21
8000.000	.548	-125	1.483	75	.059	109	.767	-22
8200.000	.539	-128	1.472	72	.062	109	.776	-23
8400.000	.528	-132	1.468	71	.065	108	.783	-24
8600.000	.515	-135	1.459	68	.067	107	.779	-25
8800.000	.502	-140	1.454	66	.068	105	.770	-26
9000.000	.494	-144	1.446	63	.061	105	.759	-26
9200.000	.489	-148	1.439	60	.069	118	.768	-25
9400.000	.480	-152	1.412	58	.080	114	.777	-26
9600.000	.474	-158	1.409	55	.084	112	.779	-28
9800.000	.468	-161	1.376	53	.089	110	.773	-29
10000.00	.470	-166	1.362	50	.092	109	.772	-30
10200.00	.466	-171	1.329	47	.096	107	.776	-32
10400.00	.444	-176	1.270	45	.099	105	.774	-34
10600.00	.439	-175	1.283	46	.098	101	.764	-36
10800.00	.445	-178	1.279	43	.089	109	.758	-35
11000.00	.444	179	1.291	40	.109	108	.805	-37
11200.00	.428	176	1.248	38	.114	105	.803	-40
11400.00	.421	172	1.253	35	.119	101	.817	-41
11600.00	.422	169	1.243	33	.121	100	.816	-43
11800.00	.408	164	1.241	31	.127	97	.822	-44
12000.00	.401	159	1.223	28	.125	96	.816	-44
12200.00	.397	153	1.229	26	.130	94	.827	-45

12400.00	.389	147	1.219	23	.133	93	.819	-45
12600.00	.390	141	1.202	20	.135	93	.823	-44
12800.00	.391	134	1.203	17	.139	92	.828	-43
13000.00	.395	127	1.156	13	.144	91	.835	-43
13200.00	.398	122	1.149	12	.150	89	.842	-44
13400.00	.403	117	1.111	9	.157	88	.851	-44
13600.00	.414	112	1.099	7	.162	85	.859	-45
13800.00	.429	108	1.086	6	.169	83	.864	-47
14000.00	.445	104	1.087	2	.176	81	.869	-48
14200.00	.459	100	1.065	1	.180	78	.860	-50
14400.00	.472	97	1.064	-3	.186	75	.845	-53
14600.00	.485	95	1.049	-4	.190	72	.834	-56
14800.00	.492	91	1.045	-8	.194	70	.820	-58
15000.00	.496	88	1.017	-10	.199	67	.806	-61
15200.00	.495	85	1.009	-13	.202	65	.807	-62
15400.00	.483	80	.965	-16	.210	62	.805	-64
15600.00	.478	76	.970	-16	.210	60	.811	-66
15800.00	.473	71	.953	-21	.222	58	.829	-68
16000.00	.473	65	.940	-21	.225	54	.838	-69
16200.00	.476	59	.951	-25	.239	53	.844	-71
16400.00	.491	54	.918	-27	.228	47	.861	-71
16600.00	.508	49	.921	-31	.240	48	.872	-73
16800.00	.541	45	.910	-32	.253	45	.869	-75
17000.00	.576	41	.896	-36	.262	42	.854	-77
17200.00	.611	38	.872	-39	.276	38	.823	-79
17400.00	.642	35	.884	-41	.273	34	.773	-82
17600.00	.653	32	.862	-45	.282	33	.740	-85
17800.00	.641	28	.823	-46	.285	29	.699	-89
18000.00	.620	26	.847	-51	.299	30	.675	-91

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

AUG 8 1980

ONR PA #21 FET CHARACTERIZATION

#2 VDD=4V ID=55.0MA

.00 VOLTS, .00 MA (MEAS 1)

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	.932	-28	1.732	153	.022	83	.800	-5
2200.000	.926	-31	1.724	150	.024	81	.801	-7
2400.000	.920	-34	1.724	147	.026	81	.800	-7
2600.000	.910	-37	1.713	145	.027	81	.798	-8
2600.000	.904	-40	1.717	142	.029	80	.803	-9
3000.000	.891	-42	1.709	140	.030	79	.797	-9
3200.000	.881	-45	1.711	137	.032	79	.797	-10
3400.000	.872	-47	1.705	134	.033	78	.797	-10
3600.000	.859	-49	1.693	131	.034	77	.794	-10
3800.000	.845	-52	1.699	128	.035	77	.792	-10
4000.000	.827	-54	1.687	125	.036	77	.787	-10
4200.000	.818	-56	1.659	123	.037	77	.784	-10
4400.000	.801	-59	1.664	120	.038	78	.781	-10
4600.000	.789	-62	1.639	118	.038	78	.776	-11
4800.000	.778	-65	1.647	115	.040	78	.777	-11
5000.000	.763	-69	1.629	112	.041	78	.777	-11
5200.000	.750	-72	1.637	110	.042	79	.773	-12
5400.000	.732	-75	1.618	107	.043	77	.771	-13
5600.000	.711	-80	1.620	103	.044	74	.770	-13
5800.000	.682	-84	1.578	100	.042	69	.759	-15
6000.000	.624	-86	1.516	97	.033	62	.746	-14
6200.000	.613	-86	1.473	97	.026	88	.750	-13
6400.000	.620	-88	1.477	96	.034	102	.760	-14
6600.000	.618	-93	1.495	93	.040	101	.763	-15
6800.000	.607	-97	1.490	90	.043	100	.761	-16
7000.000	.593	-101	1.467	88	.045	101	.757	-17
7200.000	.580	-105	1.467	86	.047	101	.756	-17
7400.000	.569	-109	1.456	83	.049	103	.752	-18
7600.000	.563	-112	1.436	82	.051	105	.753	-18
7800.000	.553	-116	1.433	79	.054	105	.755	-19
8000.000	.549	-120	1.422	78	.057	106	.754	-20
8200.000	.544	-124	1.416	74	.060	106	.762	-21
8400.000	.537	-128	1.415	73	.063	107	.768	-21
8600.000	.529	-132	1.406	70	.065	107	.763	-22
8800.000	.521	-137	1.400	68	.068	107	.759	-23
9000.000	.517	-141	1.391	65	.071	107	.762	-24
9200.000	.515	-145	1.381	62	.074	107	.753	-25
9400.000	.514	-149	1.358	60	.077	107	.750	-25
9600.000	.517	-153	1.355	57	.081	107	.749	-26
9800.000	.519	-157	1.326	55	.085	107	.742	-28
10000.00	.522	-160	1.309	52	.088	107	.740	-29
10200.00	.526	-164	1.288	50	.092	106	.742	-31
10400.00	.531	-167	1.274	48	.096	105	.742	-33
10600.00	.532	-169	1.268	46	.100	104	.741	-35
10800.00	.527	-171	1.240	43	.103	103	.749	-37
11000.00	.524	-173	1.244	41	.106	101	.757	-39
11200.00	.508	-175	1.203	39	.108	102	.752	-41
11400.00	.501	-179	1.204	37	.112	99	.764	-42
11600.00	.503	180	1.193	35	.115	99	.765	-44
11800.00	.485	176	1.190	33	.121	97	.770	-45
12000.00	.478	172	1.177	31	.121	96	.767	-45
12200.00	.473	168	1.183	28	.125	95	.777	-47

12400.00	.461	163	1.174	26	.128	94	.772	-46
12600.00	.459	157	1.164	23	.131	94	.774	-45
12800.00	.457	151	1.171	20	.135	92	.779	-45
13000.00	.458	145	1.131	16	.140	92	.783	-45
13200.00	.456	139	1.126	14	.146	90	.789	-46
13400.00	.462	133	1.094	11	.152	89	.795	-47
13600.00	.473	128	1.079	9	.156	87	.798	-47
13800.00	.487	123	1.064	7	.162	84	.800	-49
14000.00	.507	119	1.059	4	.168	83	.804	-51
14200.00	.523	116	1.033	3	.172	80	.794	-53
14400.00	.538	113	1.023	-2	.176	78	.779	-55
14600.00	.559	110	1.007	-3	.180	75	.772	-58
14800.00	.573	108	.996	-6	.183	74	.760	-61
15000.00	.588	106	.969	-8	.188	70	.745	-63
15200.00	.596	104	.960	-10	.190	69	.750	-65
15400.00	.590	102	.921	-13	.196	66	.744	-67
15600.00	.588	99	.927	-14	.195	64	.752	-69
15800.00	.584	96	.908	-18	.201	63	.769	-71
16000.00	.579	93	.898	-18	.203	60	.781	-73
16200.00	.572	90	.902	-22	.209	60	.794	-75
16400.00	.573	87	.873	-24	.214	57	.802	-76
16600.00	.575	84	.866	-27	.222	56	.800	-77
16800.00	.588	81	.853	-28	.231	53	.794	-79
17000.00	.611	78	.836	-31	.235	50	.780	-80
17200.00	.635	76	.819	-33	.245	47	.756	-82
17400.00	.665	74	.840	-34	.247	43	.713	-85
17600.00	.685	73	.826	-38	.249	42	.681	-89
17800.00	.694	72	.817	-38	.254	38	.652	-92
18000.00	.684	70	.852	-43	.253	39	.631	-95

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

AUG 8 1980

ONR PA #21 FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #3 VDD=4V ID=65.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.930	-31	1.824	152	.019	82	.810	-6
2200.000	.923	-34	1.813	149	.021	81	.811	-8
2400.000	.917	-37	1.812	146	.023	80	.809	-8
2600.000	.907	-40	1.799	143	.024	80	.809	-9
2800.000	.900	-42	1.801	140	.026	79	.811	-10
3000.000	.887	-45	1.793	138	.027	79	.805	-10
3200.000	.877	-48	1.796	135	.028	79	.807	-11
3400.000	.867	-50	1.790	132	.028	78	.806	-11
3600.000	.853	-52	1.776	129	.029	78	.803	-11
3800.000	.841	-55	1.783	126	.030	77	.801	-11
4000.000	.822	-58	1.772	123	.031	78	.796	-12
4200.000	.811	-60	1.742	121	.031	78	.792	-12
4400.000	.795	-63	1.745	118	.032	78	.789	-12
4600.000	.783	-67	1.719	115	.033	79	.783	-12
4800.000	.773	-70	1.726	113	.034	79	.783	-13
5000.000	.759	-74	1.706	109	.034	79	.783	-13
5200.000	.747	-77	1.712	107	.036	79	.779	-14
5400.000	.730	-81	1.688	104	.036	78	.779	-15
5600.000	.712	-85	1.686	100	.037	75	.776	-16
5800.000	.686	-90	1.640	96	.035	69	.764	-17
6000.000	.636	-93	1.581	93	.027	60	.750	-17
6200.000	.612	-92	1.514	93	.017	94	.751	-16
6400.000	.623	-94	1.515	92	.028	114	.763	-17
6600.000	.626	-98	1.537	90	.035	110	.767	-18
6800.000	.618	-102	1.525	87	.037	108	.766	-20
7000.000	.606	-105	1.498	84	.039	108	.761	-21
7200.000	.597	-109	1.496	82	.042	109	.759	-22
7400.000	.588	-112	1.484	80	.044	110	.754	-22
7600.000	.583	-115	1.463	78	.047	112	.757	-24
7800.000	.575	-119	1.454	75	.049	112	.760	-25
8000.000	.571	-122	1.446	74	.052	113	.761	-26
8200.000	.565	-125	1.438	71	.056	113	.769	-27
8400.000	.557	-128	1.440	69	.060	113	.776	-28
8600.000	.548	-132	1.431	66	.061	112	.772	-29
8800.000	.538	-135	1.427	64	.065	112	.768	-30
9000.000	.530	-139	1.417	61	.068	112	.771	-31
9200.000	.525	-143	1.404	58	.071	112	.764	-33
9400.000	.520	-146	1.381	56	.075	111	.764	-34
9600.000	.517	-150	1.380	53	.078	111	.764	-35
9800.000	.516	-154	1.352	51	.082	110	.760	-36
10000.00	.515	-157	1.336	48	.085	110	.761	-38
10200.00	.515	-161	1.318	46	.089	109	.766	-40
10400.00	.516	-164	1.304	44	.093	107	.769	-42
10600.00	.514	-166	1.300	42	.097	106	.772	-44
10800.00	.507	-169	1.272	39	.100	105	.782	-46
11000.00	.502	-172	1.277	37	.103	102	.793	-48
11200.00	.483	-174	1.231	34	.105	102	.787	-50
11400.00	.474	-177	1.233	32	.108	99	.800	-51
11600.00	.474	-179	1.220	30	.111	99	.802	-52
11800.00	.455	177	1.219	28	.116	97	.807	-53
12000.00	.447	173	1.201	26	.115	96	.805	-53
12200.00	.440	168	1.209	23	.120	95	.814	-54

12400.00	.426	163	1.201	21	.123	94	.809	-53
12600.00	.423	157	1.191	18	.125	93	.815	-52
12800.00	.420	151	1.199	15	.129	92	.818	-51
13000.00	.420	145	1.156	11	.134	91	.824	-51
13200.00	.418	138	1.157	9	.140	90	.833	-51
13400.00	.422	133	1.124	7	.146	88	.837	-52
13600.00	.431	127	1.116	4	.151	86	.844	-53
13800.00	.442	123	1.103	3	.157	83	.846	-54
14000.00	.459	118	1.098	-1	.163	81	.849	-56
14200.00	.473	115	1.079	-2	.167	78	.839	-58
14400.00	.484	112	1.070	-7	.172	76	.824	-60
14600.00	.502	109	1.059	-8	.177	74	.815	-63
14800.00	.513	107	1.052	-12	.180	72	.803	-65
15000.00	.521	104	1.030	-13	.186	68	.791	-68
15200.00	.524	102	1.029	-16	.189	66	.795	-70
15400.00	.518	99	.993	-18	.198	64	.795	-72
15600.00	.515	96	1.015	-19	.198	60	.803	-74
15800.00	.513	92	.999	-24	.205	59	.820	-76
16000.00	.510	88	1.006	-24	.209	55	.834	-78
16200.00	.507	84	1.018	-29	.217	55	.847	-81
16400.00	.513	79	.990	-31	.223	50	.851	-83
16600.00	.522	75	.990	-35	.231	49	.846	-85
16800.00	.544	71	.980	-37	.240	45	.835	-87
17000.00	.572	68	.963	-41	.244	42	.813	-90
17200.00	.603	65	.941	-44	.255	38	.782	-93
17400.00	.635	62	.969	-45	.252	34	.732	-97
17600.00	.659	61	.950	-50	.256	33	.702	-101
17800.00	.664	59	.934	-52	.259	27	.669	-105
18000.00	.659	58	.973	-58	.262	28	.655	-109

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

ONR28 FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #3 VDD=3V ID=20.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.927	-31	1.752	148	.067	72	.719	-12
2200.000	.914	-34	1.751	145	.073	71	.716	-13
2400.000	.897	-38	1.741	141	.079	69	.712	-15
2600.000	.888	-41	1.736	138	.085	67	.708	-16
2800.000	.865	-46	1.727	134	.090	65	.701	-17
3000.000	.849	-50	1.712	131	.095	64	.697	-18
3200.000	.835	-54	1.698	128	.099	62	.691	-18
3400.000	.822	-58	1.674	125	.103	61	.686	-19
3600.000	.806	-63	1.664	122	.107	59	.678	-19
3800.000	.791	-67	1.647	119	.111	57	.671	-19
4000.000	.780	-70	1.621	116	.113	56	.664	-19
4200.000	.762	-74	1.590	113	.116	55	.651	-20
4400.000	.748	-77	1.571	110	.119	54	.647	-20
4600.000	.734	-81	1.555	107	.121	53	.638	-20
4800.000	.721	-84	1.546	105	.124	51	.628	-20
5000.000	.700	-87	1.533	102	.127	51	.620	-21
5200.000	.685	-90	1.522	99	.130	49	.612	-21
5400.000	.669	-94	1.513	97	.133	48	.602	-22
5600.000	.648	-98	1.493	93	.136	46	.593	-23
5800.000	.617	-103	1.468	90	.136	43	.573	-23
6000.000	.572	-106	1.410	87	.126	40	.554	-22
6200.000	.561	-106	1.383	87	.120	45	.566	-22
6400.000	.569	-109	1.394	85	.126	47	.569	-23
6600.000	.570	-113	1.398	83	.131	47	.566	-24
6800.000	.555	-117	1.397	80	.135	46	.557	-25
7000.000	.543	-120	1.384	78	.136	46	.551	-25
7200.000	.527	-124	1.368	75	.138	45	.543	-26
7400.000	.513	-128	1.357	73	.139	45	.537	-26
7600.000	.499	-132	1.353	70	.141	45	.530	-27
7800.000	.485	-136	1.338	68	.142	44	.524	-28
8000.000	.472	-141	1.331	66	.145	44	.517	-28
8200.000	.463	-146	1.312	63	.145	43	.507	-29
8400.000	.456	-151	1.307	61	.148	43	.498	-30
8600.000	.454	-157	1.293	58	.148	43	.488	-30
8800.000	.454	-162	1.274	56	.149	42	.478	-31
9000.000	.454	-166	1.258	53	.151	42	.470	-32
9200.000	.460	-171	1.246	51	.152	42	.463	-33
9400.000	.461	-174	1.233	49	.154	41	.456	-34
9600.000	.464	-178	1.222	47	.155	41	.450	-34
9800.000	.466	178	1.207	44	.157	41	.441	-35
10000.00	.462	175	1.197	42	.159	40	.430	-36
10200.00	.461	171	1.190	40	.162	40	.424	-38
10400.00	.459	167	1.173	38	.164	40	.413	-39
10600.00	.455	163	1.159	35	.165	39	.401	-41
10800.00	.453	158	1.139	33	.166	38	.393	-43
11000.00	.458	154	1.141	30	.171	38	.387	-46
11200.00	.460	149	1.120	28	.172	37	.383	-49
11400.00	.464	145	1.101	25	.174	36	.382	-51
11600.00	.475	142	1.086	23	.174	36	.379	-51
11800.00	.475	138	1.064	21	.178	35	.378	-53
12000.00	.488	135	1.049	19	.179	34	.381	-53
12200.00	.487	132	1.027	17	.181	34	.376	-54

12400.00	2.41	1.84	.07	-14.82	1.75	.05
12600.00	2.70	2.04	.15	-14.50	1.62	.05
12800.00	2.63	1.98	.11	-14.31	1.61	.05
13000.00	2.40	1.78	-.05	-14.16	1.63	.05
13200.00	2.38	1.76	-.07	-13.93	1.60	.05
13400.00	2.26	1.65	-.17	-13.72	1.59	.05
13600.00	2.15	1.56	-.26	-13.53	1.58	.04
13800.00	2.07	1.50	-.37	-13.42	1.57	.04
14000.00	1.94	1.38	-.52	-13.26	1.57	.04
14200.00	1.85	1.30	-.63	-13.11	1.55	.04
14400.00	1.87	1.29	-.74	-12.93	1.51	.03
14600.00	1.72	1.16	-.91	-12.87	1.52	.03
14800.00	1.71	1.12	-1.03	-12.67	1.48	.03
15000.00	1.65	1.06	-1.10	-12.55	1.47	.03
15200.00	1.46	.88	-1.27	-12.36	1.48	.03
15400.00	1.46	.85	-1.34	-12.14	1.44	.03
15600.00	1.24	.65	-1.54	-12.02	1.46	.03
15800.00	1.14	.56	-1.63	-11.81	1.44	.03
16000.00	1.09	.49	-1.78	-11.61	1.41	.03
16200.00	.86	.31	-1.98	-11.53	1.43	.03
16400.00	.67	.14	-2.20	-11.37	1.43	.03
16600.00	.76	.20	-2.30	-11.20	1.38	.03
16800.00	.58	.05	-2.58	-11.18	1.39	.03
17000.00	.56	.02	-2.74	-11.07	1.36	.04
17200.00	.45	-.09	-3.00	-10.96	1.35	.04
17400.00	.47	-.08	-3.06	-10.83	1.33	.04
17600.00	.41	-.15	-3.19	-10.58	1.30	.04
17800.00	.34	-.22	-3.32	-10.44	1.29	.05
18000.00	-.03	-.51	-3.47	-10.26	1.33	.05

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

ONR28 FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #5 VDD=3V ID=25.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.954	-16	.252	148	.046	79	.538	-10
2200.000	.951	-18	.260	145	.050	78	.540	-11
2400.000	.949	-19	.265	142	.055	77	.540	-13
2600.000	.947	-21	.269	139	.059	76	.542	-14
2800.000	.938	-24	.273	136	.063	75	.540	-15
3000.000	.934	-26	.278	133	.068	74	.542	-16
3200.000	.933	-28	.281	130	.072	73	.541	-16
3400.000	.925	-31	.282	127	.076	72	.543	-17
3600.000	.922	-34	.285	124	.080	70	.541	-17
3800.000	.920	-36	.290	121	.084	69	.540	-18
4000.000	.917	-39	.293	118	.087	68	.537	-18
4200.000	.908	-41	.301	115	.090	67	.532	-18
4400.000	.909	-43	.303	113	.093	66	.532	-19
4600.000	.903	-45	.305	110	.096	65	.526	-19
4800.000	.898	-46	.308	108	.100	64	.521	-20
5000.000	.891	-48	.311	106	.103	63	.516	-20
5200.000	.888	-49	.316	104	.107	61	.510	-21
5400.000	.878	-52	.324	101	.112	60	.504	-22
5600.000	.871	-54	.328	97	.116	57	.499	-23
5800.000	.851	-57	.329	94	.119	54	.485	-24
6000.000	.824	-59	.314	91	.111	48	.473	-23
6200.000	.823	-59	.308	93	.101	54	.482	-23
6400.000	.832	-61	.325	92	.107	58	.483	-24
6600.000	.839	-64	.336	90	.115	58	.481	-26
6800.000	.826	-66	.344	87	.120	57	.475	-27
7000.000	.821	-69	.347	85	.123	56	.470	-27
7200.000	.817	-70	.351	83	.126	55	.463	-28
7400.000	.802	-72	.358	81	.128	54	.456	-29
7600.000	.791	-75	.368	79	.132	54	.448	-29
7800.000	.784	-77	.374	77	.134	53	.440	-30
8000.000	.769	-80	.382	75	.138	52	.434	-31
8200.000	.750	-83	.401	73	.141	50	.427	-32
8400.000	.737	-87	.409	70	.145	49	.418	-34
8600.000	.725	-91	.415	68	.147	48	.408	-35
8800.000	.714	-96	.420	65	.149	47	.399	-36
9000.000	.708	-100	.424	62	.153	45	.391	-38
9200.000	.702	-105	.427	60	.155	44	.383	-39
9400.000	.702	-108	.425	57	.157	43	.376	-40
9600.000	.696	-112	.431	55	.159	41	.371	-42
9800.000	.687	-116	.435	52	.161	40	.360	-43
10000.00	.677	-119	.438	49	.163	38	.350	-45
10200.00	.667	-123	.443	47	.166	37	.344	-47
10400.00	.651	-127	.442	44	.167	35	.333	-50
10600.00	.635	-131	.441	42	.168	34	.323	-52
10800.00	.620	-136	.439	39	.168	33	.317	-54
11000.00	.620	-141	.449	36	.173	31	.316	-57
11200.00	.609	-146	.445	33	.174	29	.315	-60
11400.00	.603	-151	.444	30	.176	27	.315	-62
11600.00	.610	-156	.444	27	.176	26	.317	-62
11800.00	.599	-160	.440	25	.180	24	.318	-63
12000.00	.608	-165	.447	22	.180	23	.322	-62
12200.00	.602	-169	.442	19	.181	22	.318	-61

12400.00	.561	-172	.419	17	.178	20	.307	-59
12600.00	.590	-178	.445	14	.187	18	.309	-57
12800.00	.585	177	.454	12	.190	17	.297	-54
13000.00	.574	171	.452	9	.192	16	.279	-51
13200.00	.571	165	.453	6	.197	13	.258	-48
13400.00	.573	159	.451	3	.201	12	.235	-46
13600.00	.572	153	.445	-0	.204	10	.210	-44
13800.00	.579	148	.444	-3	.206	8	.186	-42
14000.00	.581	143	.441	-6	.208	6	.159	-40
14200.00	.584	139	.436	-9	.212	3	.133	-40
14400.00	.592	135	.437	-11	.216	2	.113	-40
14600.00	.592	130	.437	-14	.217	-0	.094	-41
14800.00	.594	126	.436	-17	.221	-2	.079	-40
15000.00	.595	122	.439	-19	.226	-4	.066	-39
15200.00	.587	116	.438	-23	.229	-6	.054	-36
15400.00	.586	110	.437	-26	.236	-8	.046	-26
15600.00	.588	104	.429	-29	.238	-10	.040	-10
15800.00	.589	98	.427	-32	.244	-13	.042	14
16000.00	.600	92	.420	-35	.248	-15	.049	38
16200.00	.608	87	.411	-38	.251	-18	.065	53
16400.00	.615	82	.403	-41	.254	-21	.081	62
16600.00	.630	78	.401	-42	.259	-22	.099	67
16800.00	.639	74	.393	-45	.259	-25	.116	70
17000.00	.649	70	.390	-47	.262	-28	.133	71
17200.00	.656	65	.387	-50	.265	-30	.148	71
17400.00	.662	61	.385	-52	.267	-32	.164	71
17600.00	.666	57	.383	-55	.274	-33	.176	70
17800.00	.673	53	.377	-57	.277	-35	.187	69
18000.00	.659	49	.368	-60	.282	-38	.197	67

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

[illegible] OCT. 10, 19[illegible]

CH[illegible] FET CHARACTERIZATION

[illegible] .00 MF [illegible] #1 VD=4V ID=35.[illegible]

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
[illegible]	.907	-39	[illegible]	144	.023	77	.843	-8
[illegible]	.887	-43	2.191	141	.025	76	.840	-8
[illegible]	.872	-47	2.169	137	.026	75	.837	-9
[illegible]	.854	-51	2.150	134	.029	75	.832	-10
[illegible]	.832	-55	2.140	131	.030	74	.829	-10
[illegible]	.818	-59	2.116	127	.031	73	.823	-12
[illegible]	.797	-64	2.102	123	.032	73	.821	-13
[illegible]	.775	-68	2.062	120	.033	72	.820	-14
[illegible]	.758	-72	2.036	117	.035	72	.816	-14
[illegible]	.739	-76	2.002	113	.036	72	.813	-16
[illegible]	.722	-80	1.965	110	.036	72	.812	-16
[illegible]	.702	-84	1.927	107	.037	72	.810	-17
[illegible]	.687	-88	1.894	104	.037	72	.810	-18
[illegible]	.669	-92	1.860	101	.038	72	.810	-18
[illegible]	.652	-96	1.833	98	.039	72	.808	-18
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[illegible]	.608	-105	1.772	93	.039	72	.802	-19
[illegible]	.592	-109	1.755	89	.041	71	.800	-20
[illegible]	.566	-114	1.716	86	.041	67	.794	-20
[illegible]	.531	-120	1.674	82	.037	59	.777	-21
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[illegible]	[illegible]	[illegible]	1.247	[illegible]	[illegible]	[illegible]	.776	-41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.771	[illegible]
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[illegible]00.	.566	[illegible]	.989	5	.129	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	.823	-26	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	.576	65	[illegible]	-31	.137	51	.737	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	-38	.201	45	[illegible]	-91
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OCT. 10, 1980

[illegible]

[illegible] VD=1V ID=10.0MA

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[illegible]	.454	[illegible]	.814	-1	.129	13	.749	-68
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[illegible]	[illegible]	[illegible]	[illegible]	-7	.137	11	.734	-71
[illegible]	[illegible]	[illegible]	[illegible]	-7	.142	10	.751	-73
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[illegible]	.512	[illegible]	.770	-15	.155	12	.741	-79
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[illegible]	[illegible]	57	[illegible]	[illegible]	[illegible]	30	.635	-100
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CHR-30 FET CHARACTERIZATION

[illegible] VOLTS, .00 MA (MEAS 1) [illegible] VD=4V ID=36.0MA

FREQ	S11		S21		S12		S22	
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[illegible]	.884	-43	2.277	141	.026	[illegible]	[illegible]	-7
[illegible]	.866	-47	2.263	138	.027	76	.831	-8
[illegible]	.850	-52	2.253	134	.029	74	.829	-9
[illegible]	.830	-56	2.243	131	.031	74	.820	-10
[illegible]	.809	-61	2.203	127	.032	73	.815	-10
[illegible]	.795	-65	2.196	123	.034	72	.814	-12
[illegible]	.774	-70	2.149	119	.034	72	.812	-13
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[illegible]	.684	-92	1.932	104	.039	71	.799	-17
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[illegible]	.631	-104	1.842	95	.040	72	.792	-18
[illegible]	.614	-108	1.800	93	.041	73	.791	-19
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[illegible]	.474	-135	[illegible]	77	.035	104	.777	-20
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[illegible]	.485	-140	1.601	73	.046	96	.784	-23
[illegible]	[illegible]	[illegible]	1.590	70	.049	95	.781	-24
[illegible]	.466	-151	1.553	67	.051	95	.776	-25
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[illegible]	.418	-161	1.519	[illegible]	[illegible]	93	.769	-27
[illegible]	.444	[illegible]	1.407	59	[illegible]	97	.779	-29
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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[illegible]	.490	[illegible]	.978	-8	.121	[illegible]	[illegible]	-66
[illegible]	[illegible]	96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-66
[illegible]	.500	91	[illegible]	[illegible]	.126	[illegible]	[illegible]	-67
[illegible]	.510	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	.552	77	[illegible]	-14	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.159	[illegible]	.773	-85
[illegible]	.610	[illegible]	[illegible]	[illegible]	.151	[illegible]	[illegible]	[illegible]
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[illegible]	.629	[illegible]	[illegible]	[illegible]	.171	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

OCT. 10, 1980

[illegible] FET CHARACTERIZATION

[illegible] .00 MA (MEAS 1[illegible] [illegible] VD=4V ID 10.0MA

[illegible]	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
[illegible]	.986	[illegible]	1.403	[illegible]	.032	[illegible]	.840	-7
[illegible]	.925	-22	1.400	116	.035	73	[illegible]	-8
[illegible]	.914	-25	1.409	113	[illegible]	75	[illegible]	-9
[illegible]	[illegible]	-29	1.419	110	.041	73	.832	-10
[illegible]	.868	-42	1.405	137	.044	72	.827	-16
[illegible]	[illegible]	-46	1.417	[illegible]	.046	71	.820	-12
[illegible]	.866	-50	1.401	130	.049	69	.813	-13
[illegible]	.844	-54	1.407	127	.051	69	.815	-14
[illegible]	.825	-58	1.397	123	.052	67	.810	-15
[illegible]	.817	-61	1.387	120	.054	65	.807	-16
[illegible]	.801	-65	1.372	117	.056	64	.805	-17
[illegible]	.787	-68	1.348	114	.057	63	.802	-18
[illegible]	.770	-71	1.337	111	.059	63	.800	-18
[illegible]	.760	-74	1.320	109	.060	62	.799	-19
[illegible]	.747	-78	1.316	105	.061	61	.796	-20
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[illegible]	.696	[illegible]	1.294	97	.065	58	.786	-21
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[illegible]	.616	-100	[illegible]	87	.063	15	.751	-24
[illegible]	.566	-101	1.171	84	[illegible]	[illegible]	.723	-22
[illegible]	.576	-101	1.171	85	.066	[illegible]	.763	-23
[illegible]	[illegible]	-105	[illegible]	[illegible]	.055	67	.765	-24
[illegible]	.576	-110	1.215	73	.059	66	.767	-26
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[illegible]	[illegible]	-124	[illegible]	70	[illegible]	[illegible]	.753	-30
[illegible]	[illegible]	[illegible]	1.185	[illegible]	[illegible]	[illegible]	[illegible]	-31
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[illegible]	.464	[illegible]	1.170	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-143	1.155	[illegible]	[illegible]	[illegible]	.737	-35
[illegible]	[illegible]	-148	1.140	56	[illegible]	[illegible]	.737	-37
[illegible]	[illegible]	-154	1.131	54	[illegible]	[illegible]	.735	[illegible]
[illegible]	[illegible]	[illegible]	1.116	51	.071	[illegible]	[illegible]	-40
[illegible]	[illegible]	-163	1.100	47	[illegible]	[illegible]	.720	-42
[illegible]	[illegible]	[illegible]	[illegible]	45	[illegible]	[illegible]	[illegible]	-44
[illegible]	.457	-172	1.066	42	[illegible]	[illegible]	.701	-46
[illegible]	[illegible]	-177	1.053	[illegible]	[illegible]	[illegible]	[illegible]	-47
[illegible]	[illegible]	[illegible]	[illegible]	37	[illegible]	[illegible]	[illegible]	-49
[illegible]	[illegible]	[illegible]	[illegible]	34	[illegible]	[illegible]	[illegible]	-50
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[illegible]	.427	117	.825	-2	.113	52	.750	-70
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[illegible]	.452	106	.801	-7	.121	49	[illegible]	-71
[illegible]	.459	102	.790	[illegible]	[illegible]	47	.743	-73
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[illegible]	.541	69	[illegible]	[illegible]	[illegible]	[illegible]	.720	-87
[illegible]	[illegible]	65	[illegible]	-35	.154	[illegible]	.715	-88
[illegible]	.551	[illegible]	[illegible]	-37	.157	[illegible]	.712	-89
[illegible]	.563	57	[illegible]	-40	.160	24	.705	-90
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[illegible]

[illegible] OCT. 10, 1980

ONR-30 FET CHARACTERIZATION

. 0 VOLTS, .00 MA (MEAS 1) #3 VD=4V ID=35.8MA

FREQ	S11		S21		S12		S22	
[illegible]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
[illegible]	.855	-40	[illegible]	140	.023	[illegible]	.841	[illegible]
[illegible]	.882	-44	[illegible]	139	.024	75	.841	[illegible]
[illegible]	.864	-49	[illegible]	136	.026	75	.835	-10
[illegible]	.841	-52	[illegible]	132	[illegible]	74	.834	-11
[illegible]	.824	-57	[illegible]	129	[illegible]	74	.829	-11
[illegible]	.803	-60	[illegible]	125	.030	73	.823	-12
[illegible]	.788	-66	[illegible]	121	.031	73	.820	-14
[illegible]	.766	-70	[illegible]	119	.033	72	.821	-15
[illegible]	.747	-75	[illegible]	114	.033	73	.816	-16
[illegible]	.730	-79	1.993	111	.034	72	.815	-17
[illegible]	.711	-83	1.955	108	.035	72	.813	-18
[illegible]	.692	-87	1.913	104	.036	73	.812	-18
4400.0	.675	-91	1.881	102	.036	74	.811	-19
4600.0	.656	-94	1.843	98	.037	74	.810	-20
4800.0	.640	-98	1.823	96	.038	74	.810	-20
[illegible]	.614	-102	1.799	93	.033	75	.807	-21
[illegible]	.554	-107	[illegible]	90	.039	76	.806	-21
[illegible]	.582	-111	1.749	87	.040	75	.805	-22
[illegible]	.579	-116	1.717	84	.041	74	.800	-22
[illegible]	[illegible]	-122	1.687	80	.040	70	.792	-23
[illegible]	.477	-129	[illegible]	76	.035	68	.778	-23
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[illegible]	.460	-135	1.557	70	.044	104	.799	-24
[illegible]	.464	-141	1.550	69	.047	101	.802	-25
[illegible]	.457	-147	1.530	67	.050	99	.793	[illegible]
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[illegible]	.430	-159	1.491	61	.054	99	.792	[illegible]
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[illegible]	.465	-174	1.422	53	.064	103	.772	[illegible]
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[illegible]	.472	[illegible]	.910	-11	.141	66	.810	-72
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[illegible]	.517	74	.861	[illegible]	[illegible]	57	.813	-77
[illegible]	.520	71	[illegible]	-23	.155	55	.807	-79
[illegible]	.524	69	.840	-25	.160	53	[illegible]	-81
[illegible]	.541	65	.825	-28	.164	51	.807	[illegible]
[illegible]	.551	62	[illegible]	-30	.166	48	.803	-85
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[illegible]	.554	55	.789	[illegible]	.175	44	[illegible]	-88
[illegible]	.560	52	.775	-39	[illegible]	41	.800	-90
[illegible]	.566	48	.760	-40	[illegible]	40	.797	-91
[illegible]	.577	45	[illegible]	-43	.187	38	.795	-92
[illegible]	.580	42	.741	-45	.192	36	.792	-94
[illegible]	[illegible]	40	.705	[illegible]	.193	34	.793	-96
[illegible]	.605	37	[illegible]	-53	[illegible]	31	.781	-98
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.774	-101
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[illegible]

PAGE [illegible]

CHR-[illegible] FET CHARACTERIZATION

OCT. 10, 1980

[illegible] ,[illegible] (MAG [illegible] 1)

[illegible] VD=[illegible]V ID=10.0MA

FREQ	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
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[illegible]	[illegible]	-33	1.[illegible]8	143	.034	73	.849	-10
[illegible]	[illegible]	-36	1.[illegible]	14[illegible]	.036	74	.844	-10
[illegible]	.[illegible]12	-40	1.[illegible]	[illegible]	.0[illegible]	72	.842	-11
[illegible]	.[illegible]11	-45	1.[illegible]	[illegible]	.041	71	.839	-12
[illegible]	.[illegible]12	-47	1.374	132	.044	7[illegible]	.831	-13
[illegible]	[illegible]	-50	1.370	128	.046	[illegible]	.830	-15
[illegible]	[illegible]	-54	1.362	125	.049	[illegible]	.828	-16
[illegible]	.[illegible]4	-57	1.356	122	.049	67	.823	-17
[illegible]	[illegible]	-61	1.345	118	.051	65	.821	-18
[illegible]	[illegible]	-64	1.330	116	.052	65	.819	-19
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[illegible]	.[illegible]6	-70	1.303	110	.055	63	.816	-21
[illegible]	.774	-74	1.288	107	.056	62	.813	-21
[illegible]	.756	-77	1.284	104	.057	62	.813	-22
[illegible]	[illegible]	-80	1.276	101	[illegible]	61	.808	-23
[illegible]	[illegible]	-83	1.265	99	[illegible]	61	.806	-23
[illegible]	.[illegible]5	-87	1.266	[illegible]	.0[illegible]1	59	.804	-24
[illegible]	[illegible]	-91	1.257	[illegible]	[illegible]	57	.799	-25
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[illegible]	.[illegible]72	-101	1.165	84	.[illegible]2	69	.793	-25
[illegible]	[illegible]	-106	1.186	81	.051	71	.786	-27
[illegible]	[illegible]	-111	1.193	77	.[illegible]	69	.788	-28
[illegible]	[illegible]5	-116	1.189	74	.[illegible]57	[illegible]	.782	-29
[illegible]	[illegible]	-121	1.177	71	.[illegible]53	[illegible]	.775	-30
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[illegible]	[illegible]	-1[illegible]	1.[illegible]	37	.[illegible]	[illegible]	[illegible]	-50
[illegible]	.46[illegible]	-177	1.[illegible]	35	.[illegible]1	[illegible]	.754	-51
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10400.[illegible]	.424	132	.036	8	.113	31	.776	-72
[illegible]	.415	127	.020	-3	.120	33	.773	-73
[illegible]	.412	122	.010	-3	.127	33	.772	-73
[illegible]	.414	116	.005	-3	.125	36	.770	-74
[illegible]	.420	110	.794	-3	.130	37	.771	-75
[illegible]	.426	104	.785	-11	.134	42	.7[illegible]	-76
[illegible]	.437	99	.770	-11	.137	43	.7[illegible]	-78
[illegible]	.451	95	.735	-1[illegible]	.141	43	.752	-79
[illegible]	.460	91	.755	-1[illegible]	.143	45	.753	-81
[illegible]	.471	87	.744	-1[illegible]	.148	44	.7[illegible]	-83
[illegible]	.481	84	.740	-21	.152	4[illegible]	.7[illegible]	-85
[illegible]	.4[illegible]	80	.725	-27	.157	4[illegible]	.740	-87
[illegible]	.4[illegible]	7[illegible]	.721	-29	.161	39	.741	-89
[illegible]	.50[illegible]	72	.7[illegible]1	-32	.1[illegible]	3[illegible]	.746	-91
[illegible]	.507	68	.69[illegible]	-35	.170	3[illegible]	.743	-92
[illegible]	.509	6[illegible]	.692	-38	.173	31	.747	-94
[illegible]	.518	59	.677	-40	.180	30	.733	-95
[illegible]	.531	56	.660	-42	.183	27	.723	-96
[illegible]	.540	52	.660	-45	.191	23	.721	-99
[illegible]	.555	49	.633	-48	.193	20	.722	-100
[illegible]	.5[illegible]	45	.639	-51	.[illegible]	1[illegible]	.70[illegible]	-103
[illegible]	.5[illegible]	[illegible]	.6[illegible]2	-5[illegible]	.210	13	.6[illegible]	-106
[illegible]	.5[illegible]	[illegible]	.6[illegible]	-5[illegible]	.[illegible]13	1[illegible]	.8[illegible]7	-108
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.6[illegible]	-11[illegible]
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-11[illegible]
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.6[illegible]	-120
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-123
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-12[illegible]
[illegible]	.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-130

[illegible]

[illegible] CHARACTERIZATION

#4 VD=[illegible] ID=[illegible].0MA

FREQ	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
[illegible]	[illegible]	[illegible]	[illegible]	145	.023	82	[illegible]	-4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.025	81	[illegible]	-4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.027	81	[illegible]	-5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	81	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	122	.030	81	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.031	81	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.033	81	[illegible]	-7
[illegible]	[illegible]	[illegible]	[illegible]	122	.034	82	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	119	.035	82	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	115	.036	83	[illegible]	[illegible]
4000.000	[illegible]	-77	1.064	110	.037	84	[illegible]	-10
4200.000	[illegible]	-81	[illegible]	109	.038	84	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	107	.039	86	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.040	86	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.040	[illegible]	.042	87	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.043	88	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.044	88	[illegible]	-14
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.046	90	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.047	90	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.046	89	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.626	82	.042	88	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.034	107	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.504	81	.049	120	.704	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.059	116	[illegible]	-14
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.063	114	[illegible]	-15
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.067	114	[illegible]	-16
[illegible]	[illegible]	[illegible]	[illegible]	71	.070	114	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.075	114	[illegible]	-17
[illegible]	[illegible]	[illegible]	[illegible]	67	.079	115	[illegible]	-17
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.085	115	[illegible]	-18
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.091	115	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.097	115	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.104	116	[illegible]	-21
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.111	115	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.127	114	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	112	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.170	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	107	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]	1.112	12	[illegible]	20	.613	-55
[illegible]	[illegible]	126	1.075	10	[illegible]	10	[illegible]	-53
[illegible]	[illegible]	[illegible]	1.043	7	.173	13	.591	-51
[illegible]	[illegible]	[illegible]	1.018	[illegible]	[illegible]	[illegible]	[illegible]	-50
[illegible]	[illegible]	107	[illegible]	2	.111	[illegible]	[illegible]	-51
[illegible]	[illegible]	[illegible]	.967	1	[illegible]	[illegible]	[illegible]	-50
[illegible]	[illegible]	[illegible]	[illegible]	-1	[illegible]	[illegible]	[illegible]	-51
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-9	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.712	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.110	[illegible]	[illegible]	-61
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.715	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-20	[illegible]	[illegible]	.702	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-22	[illegible]	[illegible]	.701	-67
[illegible]	.617	[illegible]	[illegible]	-24	.173	[illegible]	.701	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.697	-70
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-72
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-73
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AD-A104 857   TRW DEFENSE AND SPACE SYSTEMS GROUP REDONDO BEACH CA   F/G 9/5
MONOLITHIC MICROWAVE PREAMPLIFIER.(U)
JUL 81   A BENAVIDES, R KAELBERER, T S LIN   N00014-77-C-0645
UNCLASSIFIED   TRW-S/N-32153.000   NL

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OCT. 10, 19[illegible]

CHR-[illegible] FET CHARACTERIZATION

[illegible], .00 [illegible] ([illegible] 1) #4 VD=4V ID=10.0MA

[illegible]	S11		S21		S12		S22	
[illegible]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
[illegible]	.920	-28	1.[illegible]	150	.032	80	.814	-5
[illegible]	.913	-31	1.394	147	.034	79	.814	-5
[illegible]	.904	-34	1.391	144	.037	79	.809	-5
[illegible]	.891	-37	1.401	141	.040	78	.836	-6
[illegible]	.870	-40	1.403	138	.042	77	.832	-7
[illegible]	.855	-43	1.399	135	.044	76	.824	-7
[illegible]	.84[illegible]	-47	1.406	132	.047	76	.822	-8
[illegible]	.825	-50	1.394	129	.049	75	.820	-9
[illegible]	.807	-54	1.388	126	.051	74	.812	-10
[illegible]	.790	-57	1.380	122	.053	74	.811	-11
[illegible]	.773	-60	1.368	120	.054	73	.809	-12
[illegible]	.754	-63	1.355	116	.056	73	.806	-13
[illegible]	.736	-66	1.345	114	.057	73	.803	-14
[illegible]	.717	-69	1.331	111	.058	72	.801	-14
[illegible]	.699	-73	1.329	108	.060	72	.800	-15
[illegible]	.67[illegible]	-76	1.317	105	.061	72	.796	-15
[illegible]	.65[illegible]	-80	1.306	102	.061	72	.795	-16
[illegible]	.63[illegible]	-84	1.305	99	.063	72	.793	-16
[illegible]	.609	-88	1.290	96	.051	70	.787	-17
[illegible]	.581	-93	1.290	93	.064	68	.788	-17
[illegible]	.5[illegible]	-99	1.246	[illegible]	.030	63	.763	-18
[illegible]	.47[illegible]	-98	1.147	83	.044	67	.754	-16
[illegible]	.506	-101	1.180	83	.049	85	.775	-16
[illegible]	.505	-106	1.200	85	.059	90	.780	-17
[illegible]	.4[illegible]	-112	1.200	82	.064	90	.781	-18
[illegible]	.478	-118	1.189	79	.067	90	.777	-1[illegible]
[illegible]	.47[illegible]	-123	1.170	76	.069	91	.772	-19
[illegible]	.45[illegible]	-128	1.158	74	.072	92	.76[illegible]	-2[illegible]
[illegible]	.44[illegible]	-133	1.145	72	.074	94	.7[illegible]	-20
[illegible]	.4[illegible]	-138	1.126	69	.079	95	.751	-21
[illegible]	.408	-143	1.122	67	.084	97	.751	-22
[illegible]	.424	-147	1.109	65	.088	99	.7[illegible]2	-23
[illegible]	.400	-152	1.099	6[illegible]	.094	101	.711	-24
[illegible]	.4[illegible]	-157	1.075	61	.100	1[illegible]	.7[illegible]	-25
[illegible]	.400	-161	1.073	59	.107	103	.741	-2[illegible]
[illegible]	.41[illegible]	-165	1.061	57	.115	102	.71[illegible]	-28
[illegible]	.4[illegible]5	-169	1.051	53	.124	1[illegible]3	.71[illegible]	-30
[illegible]	.4[illegible]	-173	1.033	51	.132	1[illegible]	.74[illegible]	-32
[illegible]	.4[illegible]	-177	1.0[illegible]	49	.1[illegible]	[illegible]	.71[illegible]	-3[illegible]
[illegible]	.4[illegible]	[illegible]	1.0[illegible]	47	.1[illegible]	[illegible]	.7[illegible]	-3[illegible]
[illegible]	[illegible]	[illegible]	1.0[illegible]	[illegible]	[illegible]	[illegible]	.7[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	.206	155	.917	16	.297	21	.583	-50
[illegible]	.399	140	.925	[illegible]	.296	13	.597	-54
[illegible]	.410	[illegible]	.907	10	.286	15	.615	-52
[illegible]	.417	[illegible]	.891	8	[illegible]	11	.623	-52
[illegible]	.407	[illegible]	.870	7	[illegible]	[illegible]	[illegible]	-53
[illegible]	[illegible]	[illegible]	[illegible]	3	.171	[illegible]	[illegible]	[illegible]
[illegible]	.450	110	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-54
[illegible]	.466	110	[illegible]	-2	[illegible]	21	[illegible]	-55
[illegible]	[illegible]	[illegible]	[illegible]	-4	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	101	[illegible]	-7	.132	[illegible]	[illegible]	[illegible]
[illegible]	.501	97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-11	[illegible]	[illegible]	[illegible]	-61
[illegible]	[illegible]	[illegible]	[illegible]	-14	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-16	[illegible]	[illegible]	.642	-66
[illegible]	[illegible]	[illegible]	[illegible]	-19	[illegible]	[illegible]	.641	-67
[illegible]	[illegible]	76	.716	-21	.169	[illegible]	.633	-69
[illegible]	.553	75	.717	-23	.173	[illegible]	[illegible]	-71
[illegible]	.565	72	.700	-26	.177	20	.630	-72
[illegible]	.579	68	.691	-28	.104	[illegible]	.628	-73
[illegible]	.551	66	.680	-30	.100	[illegible]	.623	-75
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-34	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-81
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #3 VD=5V ID=35MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.943	-30	1.830	151	.025	77	.859	-6
2200.000	.933	-33	1.832	149	.027	76	.857	-6
2400.000	.924	-37	1.838	146	.029	75	.854	-7
2600.000	.913	-41	1.841	143	.032	73	.853	-7
2800.000	.901	-44	1.836	140	.033	72	.845	-8
3000.000	.887	-49	1.841	136	.035	71	.840	-9
3200.000	.877	-53	1.839	134	.037	69	.841	-9
3400.000	.861	-57	1.833	130	.039	68	.833	-10
3600.000	.852	-61	1.820	127	.040	66	.829	-12
3800.000	.840	-65	1.818	124	.041	65	.829	-12
4000.000	.826	-69	1.796	121	.042	64	.825	-13
4200.000	.817	-72	1.804	118	.043	63	.823	-13
4400.000	.805	-76	1.777	115	.044	62	.820	-14
4600.000	.792	-80	1.766	112	.045	61	.817	-14
4800.000	.779	-84	1.752	109	.046	59	.813	-15
5000.000	.768	-88	1.741	106	.047	58	.812	-16
5200.000	.754	-92	1.721	103	.047	55	.805	-16
5400.000	.736	-96	1.693	100	.048	54	.805	-17
5600.000	.717	-101	1.689	97	.050	49	.791	-17
5800.000	.678	-107	1.632	93	.050	36	.773	-18
6000.000	.593	-107	1.505	91	.032	14	.753	-16
6200.000	.624	-106	1.520	92	.020	66	.782	-15
6400.000	.645	-109	1.549	90	.030	74	.787	-17
6600.000	.651	-114	1.563	87	.035	72	.791	-18
6800.000	.647	-119	1.557	84	.037	71	.789	-19
7000.000	.635	-122	1.535	82	.038	71	.784	-20
7200.000	.627	-127	1.521	79	.039	71	.784	-21
7400.000	.622	-130	1.509	76	.039	72	.780	-21
7600.000	.615	-134	1.495	74	.040	74	.782	-23
7800.000	.608	-138	1.489	72	.041	75	.781	-23
8000.000	.601	-141	1.467	69	.042	75	.775	-25
8200.000	.596	-146	1.443	66	.043	76	.779	-25
8400.000	.591	-150	1.431	64	.044	77	.771	-27
8600.000	.587	-154	1.423	61	.045	78	.766	-28
8800.000	.584	-158	1.407	58	.046	78	.770	-30
9000.000	.583	-162	1.383	55	.047	78	.767	-31
9200.000	.581	-165	1.370	53	.049	78	.768	-33
9400.000	.579	-169	1.355	50	.050	78	.768	-34
9600.000	.581	-173	1.340	48	.051	78	.769	-36
9800.000	.579	-176	1.316	45	.053	78	.771	-38
10000.00	.582	-180	1.295	42	.054	77	.775	-39
10200.00	.578	177	1.275	40	.055	76	.773	-40
10400.00	.577	174	1.264	38	.057	76	.772	-42
[illegible]	.579	171	1.243	35	.057	75	.772	-44
[illegible]	.576	168	1.226	33	.058	73	.769	-45
[illegible]	.577	165	1.210	30	.059	73	.774	-46
[illegible]	.571	162	1.194	[illegible]	[illegible]	71	.770	[illegible]
[illegible]	.569	158	1.184	25	.061	70	.771	[illegible]
[illegible]	.567	154	1.164	[illegible]	.062	69	.777	-50
[illegible]	.564	[illegible]	[illegible]	20	[illegible]	67	.773	[illegible]
[illegible]	.559	147	[illegible]	[illegible]	[illegible]	66	.770	-52
[illegible]	.554	144	1.112	15	.065	64	.787	-53

12400.00	.547	140	1.095	13	.066	64	.789	-53
12600.00	.539	136	1.076	11	.066	62	.789	-53
12800.00	.537	131	1.059	8	.068	60	.794	-53
13000.00	.535	126	1.051	6	.069	59	.797	-53
13200.00	.535	121	1.042	4	.070	57	.798	-54
13400.00	.536	117	1.035	1	.072	54	.800	-54
13600.00	.540	112	1.027	-1	.073	52	.802	-55
13800.00	.550	108	1.023	-4	.075	50	.801	-56
14000.00	.556	104	1.017	-7	.076	47	.802	-57
14200.00	.561	100	1.003	-10	.078	44	.798	-59
14400.00	.566	96	.997	-13	.080	41	.799	-61
14600.00	.571	92	.978	-16	.081	38	.796	-62
14800.00	.580	87	.979	-19	.083	35	.791	-64
15000.00	.586	83	.972	-22	.085	31	.790	-66
15200.00	.583	78	.956	-25	.086	28	.782	-67
15400.00	.583	73	.945	-29	.087	25	.782	-68
15600.00	.587	67	.928	-31	.088	22	.780	-70
15800.00	.596	62	.919	-35	.089	18	.775	-71
16000.00	.607	57	.898	-38	.091	16	.764	-72
16200.00	.617	53	.887	-41	.091	13	.763	-73
16400.00	.632	48	.865	-44	.094	10	.761	-75
16600.00	.656	45	.859	-47	.095	6	.757	-77
16800.00	.675	42	.850	-50	.096	4	.753	-79
17000.00	.694	39	.830	-53	.098	1	.747	-80
17200.00	.716	36	.804	-56	.099	-2	.743	-83
17400.00	.724	34	.797	-59	.100	-4	.724	-85
17600.00	.742	31	.790	-62	.102	-7	.713	-87
17800.00	.749	29	.775	-65	.103	-9	.693	-91
18000.00	.744	26	.764	-69	.106	-11	.693	-93

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #1 VD=5V ID=35MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.939	-33	1.853	149	.028	74	.828	-8
2200.000	.930	-36	1.849	147	.031	74	.825	-8
2400.000	.922	-39	1.848	144	.033	72	.822	-9
2600.000	.909	-43	1.846	141	.035	71	.820	-10
2800.000	.898	-46	1.838	138	.037	70	.812	-11
3000.000	.884	-50	1.842	135	.040	68	.807	-12
3200.000	.872	-54	1.833	132	.041	67	.807	-12
3400.000	.858	-58	1.822	129	.043	65	.799	-13
3600.000	.850	-61	1.803	125	.044	64	.796	-15
3800.000	.839	-65	1.794	123	.046	63	.797	-15
4000.000	.823	-69	1.768	120	.047	62	.793	-16
4200.000	.814	-71	1.768	117	.048	61	.796	-17
4400.000	.801	-74	1.739	115	.049	59	.793	-17
4600.000	.788	-77	1.727	112	.050	59	.791	-18
4800.000	.775	-80	1.715	109	.051	58	.790	-18
5000.000	.760	-84	1.710	107	.052	57	.789	-18
5200.000	.744	-87	1.700	104	.053	56	.784	-19
5400.000	.724	-91	1.687	102	.055	54	.784	-19
5600.000	.704	-96	1.691	98	.057	51	.772	-20
5800.000	.677	-102	1.668	95	.058	45	.760	-20
6000.000	.621	-107	1.605	91	.051	30	.734	-20
6200.000	.594	-106	1.538	91	.029	48	.745	-17
6400.000	.611	-109	1.567	90	.040	63	.757	-19
6600.000	.618	-114	1.589	87	.044	62	.758	-20
6800.000	.613	-119	1.589	84	.046	62	.755	-21
7000.000	.601	-123	1.572	82	.047	62	.749	-22
7200.000	.591	-128	1.564	79	.048	62	.747	-22
7400.000	.583	-132	1.555	76	.049	62	.742	-23
7600.000	.572	-137	1.543	73	.050	62	.740	-24
7800.000	.565	-142	1.539	71	.051	63	.736	-25
8000.000	.558	-147	1.514	68	.052	62	.730	-27
8200.000	.556	-153	1.495	65	.052	63	.733	-27
8400.000	.556	-158	1.478	62	.053	64	.724	-29
8600.000	.559	-163	1.464	59	.053	64	.717	-30
8800.000	.564	-168	1.439	56	.054	64	.716	-32
9000.000	.571	-172	1.407	53	.054	64	.711	-34
9200.000	.578	-176	1.386	51	.055	65	.708	-35
9400.000	.581	-179	1.364	49	.056	66	.707	-37
9600.000	.589	178	1.346	46	.057	66	.706	-39
9800.000	.589	175	1.323	44	.058	66	.708	-40
10000.00	.593	173	1.298	41	.059	66	.711	-42
10200.00	.590	170	1.280	39	.061	66	.708	-43
10400.00	.589	167	1.269	36	.062	66	.706	-45
10600.00	.591	163	1.250	34	.063	65	.705	-47
[illegible]	.591	160	1.236	31	.065	61	.702	-49
[illegible]	.595	157	1.216	29	.066	61	.703	-50
[illegible]	.597	[illegible]	1.200	26	.067	63	.700	-52
[illegible]	.601	150	1.183	24	[illegible]	62	.700	-54
[illegible]	[illegible]	[illegible]	1.153	21	.069	61	.706	-56
[illegible]	[illegible]	[illegible]	[illegible]	19	.070	[illegible]	[illegible]	[illegible]
[illegible]	.615	[illegible]	1.110	16	.071	60	[illegible]	-59
[illegible]	.618	138	1.051	14	.072	58	.711	-60

12400.00	.617	136	1.071	12	.073	58	.712	-61
12600.00	.616	133	1.051	10	.074	57	.714	-62
12800.00	.616	130	1.033	7	.075	56	.715	-62
13000.00	.615	127	1.023	6	.077	55	.715	-63
13200.00	.615	124	1.010	3	.078	53	.714	-64
13400.00	.616	120	1.001	1	.080	52	.709	-65
13600.00	.619	117	.988	-2	.081	50	.707	-66
13800.00	.627	113	.978	-4	.083	48	.704	-68
14000.00	.633	111	.968	-6	.085	46	.702	-69
14200.00	.640	108	.950	-8	.086	44	.695	-71
14400.00	.647	105	.941	-11	.088	43	.698	-73
14600.00	.654	103	.920	-13	.089	41	.696	-75
14800.00	.664	101	.919	-16	.091	39	.693	-77
15000.00	.672	99	.911	-18	.092	37	.691	-79
15200.00	.668	96	.895	-20	.094	35	.687	-80
15400.00	.657	93	.883	-24	.097	33	.688	-82
15600.00	.660	90	.875	-25	.098	31	.685	-83
15800.00	.659	87	.871	-28	.100	28	.683	-84
16000.00	.660	84	.859	-31	.104	27	.675	-86
16200.00	.662	80	.854	-34	.104	25	.677	-87
16400.00	.665	77	.839	-36	.108	21	.672	-89
16600.00	.682	74	.834	-39	.110	19	.669	-92
16800.00	.694	71	.824	-42	.112	17	.663	-94
17000.00	.706	69	.815	-44	.115	14	.657	-97
17200.00	.720	67	.790	-47	.117	12	.654	-100
17400.00	.728	65	.786	-49	.118	9	.639	-103
17600.00	.742	64	.776	-52	.121	8	.631	-107
17800.00	.757	63	.773	-55	.122	6	.624	-111
18000.00	.740	61	.763	-58	.126	4	.629	-114

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

PAGE 1: 5 SEP 9,1980

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #2 VD=5V ID=28.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.940	-31	1.500	151	.026	75	.864	-7
2200.000	.933	-34	1.489	149	.028	74	.862	-8
2400.000	.926	-37	1.482	146	.030	73	.860	-8
2600.000	.917	-39	1.477	143	.032	72	.859	-8
2800.000	.909	-42	1.467	141	.033	71	.853	-9
3000.000	.897	-44	1.469	138	.035	71	.847	-10
3200.000	.889	-47	1.466	136	.037	70	.851	-11
3400.000	.876	-49	1.465	133	.038	69	.842	-12
3600.000	.865	-52	1.464	130	.040	68	.839	-13
3800.000	.852	-54	1.474	128	.041	68	.840	-14
4000.000	.836	-57	1.473	125	.043	67	.836	-15
4200.000	.825	-60	1.478	122	.043	66	.837	-16
4400.000	.808	-63	1.468	119	.045	65	.833	-17
4600.000	.791	-67	1.470	116	.046	64	.831	-17
4800.000	.774	-71	1.467	113	.048	62	.829	-18
5000.000	.760	-75	1.467	110	.049	60	.828	-19
5200.000	.743	-80	1.459	107	.050	58	.821	-20
5400.000	.722	-84	1.441	103	.051	54	.821	-21
5600.000	.697	-90	1.434	99	.054	48	.806	-22
5800.000	.645	-96	1.369	95	.050	31	.781	-22
6000.000	.588	-94	1.265	95	.028	19	.778	-20
6200.000	.622	-96	1.291	95	.021	64	.799	-20
6400.000	.635	-100	1.310	92	.030	76	.803	-22
6600.000	.637	-105	1.315	89	.035	75	.810	-23
6800.000	.634	-110	1.307	86	.037	73	.810	-24
7000.000	.623	-114	1.282	84	.038	73	.805	-25
7200.000	.617	-118	1.267	81	.039	73	.805	-26
7400.000	.613	-121	1.251	79	.039	74	.802	-26
7600.000	.608	-125	1.234	76	.039	75	.801	-28
7800.000	.604	-128	1.226	74	.040	77	.799	-28
8000.000	.601	-132	1.201	72	.041	78	.796	-30
8200.000	.599	-135	1.184	69	.042	81	.802	-30
8400.000	.595	-138	1.169	67	.043	82	.794	-32
8600.000	.594	-141	1.161	64	.044	82	.783	-33
8800.000	.591	-144	1.145	62	.044	83	.791	-35
9000.000	.591	-147	1.126	59	.045	84	.789	-36
9200.000	.588	-149	1.115	57	.046	85	.788	-38
9400.000	.584	-152	1.104	55	.048	86	.783	-40
9600.000	.585	-155	1.091	53	.050	86	.792	-41
9800.000	.583	-158	1.076	50	.051	85	.792	-44
10000.000	.582	-160	1.057	48	.053	85	.797	-45
10200.000	.579	-163	1.040	45	.054	85	.796	-46
10400.000	.574	-165	1.027	[illegible]	.055	84	.793	-4[illegible]
[illegible]	[illegible]	-1[illegible]	1.[illegible]	41	.056	84	.795	-4[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.793	-51
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.79[illegible]	-5[illegible]

12400.00	.493	171	.927	22	.067	78	.811	-61
12600.00	.475	167	.918	19	.068	77	.815	-62
12800.00	.463	161	.905	16	.070	76	.821	-62
13000.00	.457	155	.902	14	.072	74	.825	-63
13200.00	.456	149	.890	11	.073	73	.832	-63
13400.00	.460	143	.822	9	.075	71	.834	-64
13600.00	.467	138	.873	6	.077	68	.838	-65
13800.00	.476	133	.863	3	.079	66	.839	-67
14000.00	.487	130	.856	1	.081	64	.843	-68
14200.00	.494	127	.841	-2	.082	61	.837	-70
14400.00	.498	123	.834	-5	.084	58	.840	-72
14600.00	.503	120	.816	-7	.084	55	.839	-73
14800.00	.505	116	.816	-10	.086	52	.837	-76
15000.00	.509	113	.804	-12	.087	49	.839	-77
15200.00	.504	109	.792	-15	.089	47	.832	-78
15400.00	.495	104	.784	-19	.090	44	.838	-80
15600.00	.496	99	.772	-21	.090	42	.836	-81
15800.00	.497	94	.766	-24	.092	39	.835	-81
16000.00	.502	90	.751	-26	.094	36	.833	-82
16200.00	.507	85	.748	-29	.095	34	.834	-82
16400.00	.512	80	.733	-31	.097	31	.837	-83
16600.00	.528	76	.732	-34	.099	28	.839	-84
16800.00	.542	71	.725	-37	.101	26	.839	-85
17000.00	.557	67	.723	-40	.104	23	.834	-86
17200.00	.575	63	.716	-42	.107	20	.833	-87
17400.00	.590	59	.706	-45	.109	17	.814	-90
17600.00	.611	56	.702	-49	.111	14	.797	-92
17800.00	.626	51	.699	-52	.113	11	.779	-95
18000.00	.636	48	.683	-56	.117	9	.787	-97

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

PAGE 1: 1 SEPT. 19, 1980

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #5 VD=4V ID=30.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.949	-27	1.888	154	.033	75	.832	-6
2200.000	.940	-30	1.896	152	.037	75	.829	-7
2400.000	.932	-33	1.910	149	.040	73	.824	-7
2600.000	.919	-36	1.921	146	.043	72	.820	-8
2800.000	.909	-39	1.929	143	.045	70	.810	-9
3000.000	.895	-43	1.941	140	.048	68	.803	-11
3200.000	.886	-47	1.949	137	.051	67	.803	-12
3400.000	.870	-50	1.941	134	.053	65	.794	-14
3600.000	.860	-54	1.941	131	.055	63	.791	-15
3800.000	.846	-57	1.944	128	.057	62	.788	-16
4000.000	.829	-61	1.931	124	.059	60	.782	-18
4200.000	.819	-65	1.923	122	.060	59	.787	-18
4400.000	.805	-68	1.894	118	.061	57	.781	-19
4600.000	.791	-72	1.882	115	.063	56	.779	-20
4800.000	.775	-76	1.876	112	.065	55	.774	-21
5000.000	.760	-80	1.858	110	.066	53	.768	-22
5200.000	.747	-83	1.844	107	.067	50	.761	-23
5400.000	.727	-88	1.817	103	.068	48	.760	-24
5600.000	.704	-93	1.806	100	.071	44	.747	-25
5800.000	.668	-98	1.758	96	.071	35	.729	-26
6000.000	.599	-100	1.647	94	.053	24	.708	-24
6200.000	.613	-99	1.638	95	.043	48	.737	-23
6400.000	.627	-102	1.660	93	.051	52	.743	-25
6600.000	.630	-107	1.676	89	.055	52	.743	-25
6800.000	.625	-112	1.667	87	.056	52	.739	-26
7000.000	.617	-116	1.650	84	.057	51	.736	-27
7200.000	.609	-121	1.629	81	.058	50	.731	-27
7400.000	.602	-125	1.613	79	.059	50	.723	-28
7600.000	.595	-128	1.594	76	.059	50	.722	-30
7800.000	.589	-132	1.581	74	.059	50	.714	-31
8000.000	.583	-136	1.551	72	.059	50	.711	-33
8200.000	.579	-140	1.531	69	.058	50	.721	-33
8400.000	.575	-144	1.510	66	.058	51	.715	-34
8600.000	.572	-148	1.496	64	.058	51	.710	-36
8800.000	.569	-152	1.479	62	.058	51	.711	-36
9000.000	.567	-156	1.458	59	.058	52	.711	-36
9200.000	.566	-159	1.441	57	.059	52	.711	-37
9400.000	.563	-163	1.421	55	.060	52	.704	-37
9600.000	.570	-167	1.407	52	.061	52	.697	-39
9800.000	.571	-170	1.386	50	.062	52	.694	-41
10000.00	.572	-173	1.368	47	.062	51	.697	-42
10200.00	.563	-176	1.349	45	.063	50	.694	-44
10400.00	.565	-179	1.342	43	.064	50	.693	-45
[illegible]	[illegible]	177	1.321	40	.064	49	.680	-47
[illegible]	.570	175	1.310	38	[illegible]	49	.683	-49
[illegible]	.566	172	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-51
[illegible]	[illegible]	[illegible]	[illegible]	31	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.553	156	1.233	24	.071	[illegible]	[illegible]	-54
[illegible]	.551	152	1.222	21	.070	[illegible]	.604	-55

12400.00	.549	148	1.207	19	.074	42	.678	-57
12600.00	.551	145	1.199	17	.074	42	.679	-58
12800.00	.543	141	1.182	14	.075	40	.683	-60
13000.00	.536	136	1.173	11	.076	38	.688	-61
13200.00	.533	131	1.166	9	.077	36	.691	-62
13400.00	.538	126	1.160	7	.078	35	.687	-62
13600.00	.549	121	1.146	3	.080	33	.687	-63
13800.00	.561	118	1.142	1	.081	31	.693	-64
14000.00	.570	114	1.136	-2	.084	29	.685	-65
14200.00	.571	110	1.122	-5	.086	27	.673	-67
14400.00	.578	107	1.112	-8	.089	25	.668	-69
14600.00	.579	103	1.093	-11	.090	23	.662	-71
14800.00	.588	99	1.088	-14	.093	19	.659	-74
15000.00	.598	96	1.071	-17	.095	17	.655	-75
15200.00	.599	91	1.058	-20	.097	13	.642	-78
15400.00	.601	87	1.050	-24	.098	10	.640	-81
15600.00	.595	82	1.031	-27	.099	8	.640	-83
15800.00	.596	76	1.008	-31	.102	5	.638	-84
16000.00	.615	71	.994	-34	.103	2	.633	-85
16200.00	.635	67	.968	-38	.104	-1	.614	-86
16400.00	.652	63	.943	-41	.106	-4	.601	-88
16600.00	.669	58	.919	-44	.108	-6	.593	-90
16800.00	.681	56	.883	-46	.109	-9	.575	-91
17000.00	.697	53	.870	-49	.109	-12	.531	-94
17200.00	.701	51	.836	-52	.111	-13	.529	-97
17400.00	.709	49	.822	-55	.111	-17	.510	-101
17600.00	.711	46	.801	-57	.111	-19	.503	-105
17800.00	.726	46	.782	-59	.112	-20	.494	-107
18000.00	.730	44	.769	-62	.113	-22	.476	-110

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

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ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #5 VD=4V ID=10.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.953	-24	1.530	155	.043	75	.837	-7
2200.000	.945	-27	1.545	153	.047	74	.834	-8
2400.000	.938	-29	1.550	150	.051	73	.829	-8
2600.000	.925	-32	1.572	147	.055	71	.824	-9
2800.000	.916	-35	1.581	144	.059	69	.815	-11
3000.000	.902	-39	1.593	141	.063	68	.807	-12
3200.000	.896	-42	1.604	138	.067	66	.807	-14
3400.000	.880	-45	1.600	135	.070	64	.797	-15
3600.000	.871	-49	1.601	132	.073	62	.793	-17
3800.000	.857	-52	1.610	129	.076	61	.789	-18
4000.000	.843	-55	1.605	126	.079	59	.783	-20
4200.000	.834	-59	1.614	123	.081	57	.783	-21
4400.000	.818	-62	1.594	120	.083	55	.776	-22
4600.000	.804	-65	1.593	117	.086	54	.772	-22
4800.000	.788	-69	1.590	114	.089	52	.767	-23
5000.000	.774	-73	1.584	111	.091	50	.759	-25
5200.000	.762	-77	1.575	108	.093	48	.752	-26
5400.000	.742	-80	1.554	104	.095	45	.750	-27
5600.000	.719	-85	1.548	101	.099	42	.736	-28
5800.000	.681	-90	1.504	97	.100	35	.716	-29
6000.000	.626	-90	1.423	95	.082	26	.695	-27
6200.000	.640	-90	1.421	96	.072	40	.721	-27
6400.000	.649	-94	1.446	93	.080	43	.724	-28
6600.000	.643	-98	1.456	90	.084	42	.723	-29
6800.000	.636	-103	1.459	88	.086	42	.717	-30
7000.000	.625	-107	1.445	85	.087	41	.712	-31
7200.000	.615	-112	1.433	82	.089	39	.705	-32
7400.000	.609	-116	1.421	79	.090	38	.696	-32
7600.000	.603	-120	1.408	77	.090	37	.693	-34
7800.000	.597	-124	1.397	74	.090	36	.685	-35
8000.000	.590	-127	1.371	72	.090	35	.679	-37
8200.000	.584	-130	1.351	69	.089	35	.685	-38
8400.000	.576	-134	1.333	67	.089	34	.678	-39
8600.000	.571	-138	1.328	64	.088	33	.672	-40
8800.000	.563	-142	1.315	62	.088	33	.671	-41
9000.000	.559	-146	1.305	59	.088	32	.670	-41
9200.000	.552	-150	1.290	56	.089	32	.668	-42
9400.000	.549	-155	1.278	54	.090	31	.659	-42
9600.000	.557	-159	1.259	51	.090	30	.650	-44
9800.000	.560	-162	1.240	49	.090	29	.645	-46
10000.00	.561	-165	1.223	47	.091	28	.647	-47
10200.00	.552	-168	1.213	44	.091	27	.640	-49
10400.00	.551	-171	1.208	42	.091	26	.639	-50
10600.00	.55[illegible]	-174	1.[illegible]	40	.091	[illegible]	.634	-52
[illegible]	.[illegible]	-17[illegible]	1.[illegible]	37	.[illegible]1	[illegible]	.631	-54
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-55
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-60
[illegible]	.[illegible]	1[illegible]	1.[illegible]	20	.0[illegible]	17	.618	-61

12400.00	.524	155	1.097	17	.099	15	.610	-63
12600.00	.525	153	1.087	15	.098	14	.610	-65
12800.00	.513	149	1.075	12	.099	13	.610	-67
13000.00	.496	144	1.072	10	.100	11	.614	-68
13200.00	.488	138	1.067	7	.102	9	.614	-68
13400.00	.495	132	1.063	4	.102	8	.606	-69
13600.00	.502	127	1.051	1	.104	6	.604	-69
13800.00	.509	122	1.040	-2	.105	5	.605	-71
14000.00	.514	119	1.030	-5	.108	3	.594	-72
14200.00	.529	114	1.021	-8	.110	1	.580	-74
14400.00	.540	111	1.015	-11	.113	-1	.572	-76
14600.00	.538	108	.999	-14	.114	-3	.563	-79
14800.00	.538	104	.995	-17	.117	-6	.557	-81
15000.00	.545	100	.988	-20	.120	-8	.551	-83
15200.00	.548	96	.975	-23	.121	-11	.537	-86
15400.00	.548	91	.975	-27	.123	-13	.535	-89
15600.00	.531	84	.948	-30	.125	-15	.532	-91
15800.00	.532	77	.933	-34	.127	-18	.527	-92
16000.00	.566	72	.913	-37	.129	-20	.516	-92
16200.00	.594	68	.902	-40	.130	-23	.495	-94
16400.00	.605	65	.878	-44	.130	-26	.479	-96
16600.00	.605	61	.859	-47	.132	-28	.467	-97
16800.00	.621	58	.837	-50	.133	-31	.443	-99
[illegible]	.656	55	.828	-52	.134	-33	.401	-102
[illegible]	.660	54	.807	-56	.134	-35	.396	-105
[illegible]	.661	52	.794	-59	.134	-37	.379	-110
[illegible]	.654	48	.776	-63	.134	-38	.370	-114
[illegible]	.678	45	.764	-65	.134	-40	.363	-116
[illegible]	.704	42	.745	-69	.135	-42	.350	-120

[illegible]: IN= 5.40, OUT= 5.48

SEPT. 19, 1980

ONR PA PAC-2 #?
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #6 VD=4V ID=25.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.937	-32	1.795	150	.033	72	.840	-8
2200.000	.927	-35	1.782	147	.035	71	.838	-10
2400.000	.916	-39	1.775	144	.038	69	.835	-10
2600.000	.902	-42	1.761	140	.040	67	.833	-11
2800.000	.890	-46	1.744	138	.042	66	.829	-12
3000.000	.878	-50	1.734	134	.044	65	.824	-13
3200.000	.867	-53	1.718	132	.046	64	.830	-13
3400.000	.852	-57	1.697	129	.048	62	.822	-14
3600.000	.844	-60	1.686	126	.050	61	.820	-14
3800.000	.832	-63	1.684	124	.051	60	.819	-14
4000.000	.817	-67	1.673	121	.053	59	.815	-14
4200.000	.807	-70	1.672	119	.053	59	.819	-14
4400.000	.793	-73	1.658	116	.055	57	.813	-15
4600.000	.776	-77	1.654	113	.056	56	.810	-15
4800.000	.762	-81	1.659	110	.058	55	.804	-15
5000.000	.747	-85	1.646	108	.059	54	.799	-16
5200.000	.736	-89	1.637	104	.060	52	.794	-17
5400.000	.718	-93	1.613	101	.061	50	.794	-18
5600.000	.699	-97	1.605	98	.063	47	.782	-19
5800.000	.680	-102	1.578	95	.065	42	.772	-20
6000.000	.637	-105	1.525	91	.062	30	.751	-21
6200.000	.607	-104	1.452	91	.042	31	.747	-19
6400.000	.612	-105	1.460	90	.040	48	.766	-20
6600.000	.615	-109	1.497	88	.047	54	.776	-21
6800.000	.602	-113	1.503	85	.050	53	.772	-22
7000.000	.585	-118	1.498	82	.051	53	.770	-23
7200.000	.570	-123	1.491	79	.052	52	.769	-24
7400.000	.555	-128	1.482	76	.052	52	.762	-25
7600.000	.544	-134	1.467	73	.052	52	.762	-26
7800.000	.539	-139	1.450	70	.052	52	.755	-27
8000.000	.537	-144	1.422	68	.052	52	.753	-29
8200.000	.535	-149	1.392	64	.052	53	.765	-29
8400.000	.535	-154	1.372	62	.052	53	.757	-31
8600.000	.538	-158	1.353	59	.052	53	.753	-32
8800.000	.536	-162	1.336	57	.052	54	.754	-33
9000.000	.534	-166	1.310	54	.052	54	.755	-34
9200.000	.532	-170	1.297	52	.052	55	.756	-34
9400.000	.530	-174	1.274	50	.052	56	.753	-35
9600.000	.538	-178	1.262	47	.054	56	.751	-36
9800.000	.540	178	1.237	45	.055	56	.749	-38
10000.00	.543	176	1.215	42	.056	56	.754	-40
10200.00	.540	173	1.197	39	.056	55	.752	-42
10400.00	.546	170	1.183	37	.058	55	.754	-44
[illegible]	.554	[illegible]	1.134	35	[illegible]	54	[illegible]	[illegible]
[illegible]	.551	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.490	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-52
[illegible]	.400	142	1.031	13	[illegible]	[illegible]	[illegible]	-52

12400.00	.491	138	1.011	15	.066	49	.786	-52
12600.00	.494	134	.999	13	.066	48	.786	-51
12800.00	.486	131	.988	11	.067	47	.790	-51
13000.00	.477	126	.981	9	.069	45	.793	-51
13200.00	.476	121	.983	7	.071	43	.791	-51
13400.00	.476	117	.985	5	.072	42	.791	-51
13600.00	.477	111	.984	2	.074	40	.794	-51
13800.00	.476	106	.989	-1	.076	38	.795	-52
14000.00	.489	98	.987	-5	.077	35	.782	-52
14200.00	.487	93	.962	-7	.079	34	.763	-53
14400.00	.501	89	.956	-10	.081	31	.747	-54
14600.00	.510	85	.934	-13	.083	29	.753	-56
14800.00	.526	81	.926	-16	.086	26	.753	-58
15000.00	.543	78	.907	-18	.088	24	.753	-59
15200.00	.552	76	.899	-21	.090	21	.742	-62
15400.00	.552	73	.889	-24	.091	18	.735	-64
15600.00	.540	69	.882	-26	.092	16	.742	-66
15800.00	.538	63	.872	-30	.094	13	.746	-66
16000.00	.549	59	.867	-32	.097	11	.748	-67
16200.00	.557	54	.858	-36	.098	8	.749	-67
16400.00	.564	49	.839	-38	.101	7	.747	-68
16600.00	.577	44	.829	-41	.104	5	.740	-69
16800.00	.596	41	.811	-43	.107	3	.727	-69
17000.00	.619	40	.811	-46	.111	0	.694	-71
17200.00	.626	38	.781	-48	.113	-1	.690	-72
17400.00	.637	37	.793	-50	.117	-4	.681	-75
17600.00	.649	35	.709	-53	.119	-6	.671	-77
17800.00	.659	33	.789	-55	.122	-9	.659	-79
18000.00	.656	31	.789	-60	.126	-12	.647	-83

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

SEPT. 19, 1980

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ONR PA PAC-2 #9
FET CHARACTERIZATION

#7 VD=4V ID=25.0MA

.00 VOLTS, .00 MA (MEAS 1)

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	.952	-29	1.641	153	.038	72	.860	-8
2200.000	.942	-32	1.642	150	.041	71	.858	-9
2400.000	.931	-35	1.651	147	.044	70	.853	-9
2600.000	.917	-39	1.656	144	.047	68	.849	-10
2800.000	.904	-42	1.654	140	.050	66	.840	-11
3000.000	.891	-46	1.658	137	.053	65	.832	-12
3200.000	.879	-50	1.654	134	.055	63	.834	-13
3400.000	.863	-53	1.633	131	.057	62	.824	-14
3600.000	.853	-56	1.628	128	.059	60	.820	-15
3800.000	.838	-60	1.625	125	.061	59	.818	-16
4000.000	.822	-63	1.610	122	.063	57	.813	-17
4200.000	.812	-66	1.602	120	.064	57	.815	-17
4400.000	.798	-68	1.583	117	.065	55	.809	-18
4600.000	.780	-71	1.578	114	.067	54	.806	-19
4800.000	.764	-75	1.581	111	.069	53	.799	-20
5000.000	.747	-78	1.571	109	.070	52	.795	-21
5200.000	.732	-82	1.565	105	.072	50	.790	-22
5400.000	.710	-86	1.549	102	.073	48	.789	-23
5600.000	.685	-90	1.546	99	.076	45	.779	-24
5800.000	.656	-95	1.519	95	.077	40	.764	-25
6000.000	.601	-99	1.457	91	.071	30	.742	-25
6200.000	.576	-99	1.398	92	.053	35	.746	-23
6400.000	.581	-101	1.407	90	.054	46	.759	-24
6600.000	.583	-106	1.437	88	.060	48	.765	-25
6800.000	.575	-111	1.437	85	.063	48	.759	-26
7000.000	.567	-115	1.431	82	.063	47	.756	-28
7200.000	.559	-121	1.422	79	.064	46	.752	-29
7400.000	.550	-125	1.405	76	.064	46	.745	-30
7600.000	.540	-129	1.381	73	.064	46	.745	-31
7800.000	.532	-133	1.358	71	.064	46	.740	-32
8000.000	.524	-136	1.327	69	.064	46	.737	-34
8200.000	.517	-140	1.306	66	.063	47	.748	-35
8400.000	.512	-144	1.294	64	.063	47	.741	-36
8600.000	.509	-148	1.289	62	.063	47	.734	-37
8800.000	.507	-153	1.283	59	.063	47	.734	-38
9000.000	.507	-157	1.266	56	.063	48	.734	-38
9200.000	.509	-162	1.256	53	.064	49	.733	-39
9400.000	.509	-167	1.236	51	.065	49	.725	-40
9600.000	.521	-171	1.223	48	.065	48	.719	-43
9800.000	.524	-174	1.200	46	.066	48	.719	-45
10000.00	.527	-176	1.179	44	.067	47	.723	-47
10200.00	.521	-179	1.162	41	.068	47	.721	-49
[illegible]	.521	179	1.156	39	[illegible]	46	.724	-50
[illegible]	.522	176	1.140	37	[illegible]	[illegible]	.720	-52
[illegible]	.518	174	1.133	35	[illegible]	[illegible]	[illegible]	-54

12400.00	.506	144	1.015	15	.080	40	.720	-64
12600.00	.505	142	1.002	13	.080	40	.722	-65
12800.00	.493	139	.991	10	.082	38	.727	-67
13000.00	.478	134	.983	8	.084	37	.735	-67
13200.00	.471	128	.982	5	.085	35	.736	-68
13400.00	.470	123	.977	3	.087	34	.729	-68
13600.00	.477	116	.964	-1	.089	32	.728	-69
13800.00	.491	111	.955	-3	.091	30	.731	-71
14000.00	.513	105	.944	-7	.093	27	.718	-72
14200.00	.515	101	.915	-9	.094	26	.703	-75
14400.00	.528	99	.901	-12	.096	24	.702	-77
14600.00	.534	97	.882	-14	.097	21	.701	-80
14800.00	.541	94	.873	-17	.099	19	.706	-81
15000.00	.549	92	.861	-19	.101	17	.709	-83
15200.00	.547	89	.850	-21	.102	15	.701	-84
15400.00	.542	85	.843	-24	.104	13	.705	-85
15600.00	.534	79	.831	-27	.105	11	.711	-86
15800.00	.538	73	.813	-30	.108	9	.716	-85
16000.00	.559	69	.801	-32	.111	8	.715	-84
16200.00	.579	65	.788	-35	.112	6	.696	-85
16400.00	.600	62	.772	-37	.116	4	.686	-87
16600.00	.619	60	.765	-39	.120	2	.682	-88
16800.00	.635	59	.756	-41	.123	0	.672	-89
17000.00	.649	57	.757	-43	.125	-2	.635	-92
17200.00	.643	57	.740	-45	.130	-3	.633	-93
17400.00	.644	55	.753	-48	.132	-5	.625	-97
17600.00	.644	52	.749	-51	.136	-7	.627	-99
17800.00	.648	49	.749	-54	.141	-9	.621	-100
18000.00	.648	46	.745	-58	.145	-12	.602	-102

REF PLANT EXT(CM): IN= 5.48, OUT= 5.48

SEPT. 19, 1980

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #8 VD=4V ID=25.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.940	-30	1.603	150	.036	69	.846	-12
2200.000	.931	-33	1.585	147	.038	68	.842	-13
2400.000	.923	-35	1.577	145	.041	67	.839	-14
2600.000	.911	-38	1.565	142	.043	65	.835	-15
2800.000	.903	-41	1.552	139	.045	64	.829	-16
3000.000	.890	-43	1.548	136	.048	63	.823	-18
3200.000	.883	-45	1.544	134	.050	62	.825	-19
3400.000	.868	-47	1.531	131	.051	61	.819	-20
3600.000	.860	-50	1.531	129	.053	60	.816	-21
3800.000	.844	-52	1.538	126	.056	59	.814	-22
4000.000	.828	-55	1.537	124	.058	58	.809	-23
4200.000	.818	-57	1.547	121	.058	57	.816	-23
4400.000	.800	-60	1.537	118	.060	56	.808	-24
4600.000	.781	-63	1.545	115	.062	55	.803	-24
4800.000	.763	-67	1.552	112	.064	53	.800	-25
5000.000	.746	-71	1.551	109	.066	52	.793	-26
5200.000	.730	-75	1.548	106	.068	49	.787	-28
5400.000	.710	-79	1.534	102	.069	47	.785	-29
5600.000	.687	-84	1.528	99	.071	44	.773	-31
5800.000	.666	-89	1.504	95	.072	39	.760	-33
6000.000	.622	-94	1.451	91	.070	28	.741	-34
6200.000	.581	-94	1.365	90	.050	27	.740	-32
6400.000	.597	-95	1.378	90	.046	41	.756	-32
6600.000	.600	-100	1.396	87	.052	46	.765	-33
6800.000	.595	-104	1.394	85	.055	46	.761	-33
7000.000	.586	-109	1.382	82	.055	46	.760	-34
7200.000	.577	-113	1.373	79	.057	46	.753	-34
7400.000	.571	-117	1.365	76	.057	46	.743	-34
7600.000	.563	-122	1.356	74	.057	46	.738	-36
7800.000	.560	-126	1.351	72	.057	46	.726	-37
8000.000	.558	-129	1.331	69	.057	46	.719	-40
8200.000	.554	-133	1.315	66	.057	47	.723	-41
8400.000	.550	-137	1.299	63	.057	47	.713	-43
8600.000	.546	-140	1.293	61	.058	46	.707	-46
8800.000	.542	-144	1.282	58	.058	46	.703	-48
9000.000	.540	-147	1.270	55	.058	46	.710	-50
9200.000	.535	-150	1.258	52	.058	47	.711	-51
9400.000	.520	-154	1.246	50	.059	47	.705	-53
9600.000	.532	-158	1.231	47	.060	47	.701	-55
9800.000	.531	-162	1.210	44	.061	46	.701	-58
10000.00	.533	-165	1.190	41	.061	45	.701	-60
10200.00	.527	-168	1.170	38	.062	44	.694	-63
10400.00	.531	-171	1.156	36	.062	44	.692	-66
10600.00	.530	-173	1.130	34	.062	43	.691	-70
[illegible]	[illegible]	-175	1.117	32	.062	42	.697	-72
[illegible]	[illegible]	-177	[illegible]	[illegible]	.062	[illegible]	[illegible]	-74
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12400.00	.474	160	1.024	13	.072	36	.706	-80
12600.00	.472	155	1.014	10	.073	34	.702	-82
12800.00	.465	150	.999	7	.074	32	.696	-84
13000.00	.460	144	.995	4	.075	29	.689	-86
13200.00	.463	138	.988	1	.075	27	.679	-88
13400.00	.474	133	.978	-1	.076	25	.674	-90
13600.00	.485	128	.959	-4	.076	23	.684	-92
13800.00	.500	124	.953	-7	.076	22	.698	-91
14000.00	.514	119	.941	-10	.079	20	.695	-91
14200.00	.516	116	.916	-13	.080	18	.672	-92
14400.00	.529	114	.909	-15	.082	17	.662	-92
14600.00	.534	112	.892	-18	.085	14	.667	-94
14800.00	.542	109	.889	-20	.087	11	.646	-96
15000.00	.552	107	.880	-23	.088	7	.601	-99
15200.00	.553	105	.873	-25	.088	5	.548	-102
15400.00	.552	102	.876	-29	.088	3	.526	-106
15600.00	.541	98	.848	-31	.088	3	.520	-107
15800.00	.537	93	.866	-35	.092	2	.528	-107
16000.00	.545	88	.841	-37	.097	1	.539	-108
16200.00	.557	84	.845	-40	.100	-2	.559	-112
16400.00	.567	80	.828	-44	.105	-5	.601	-115
16600.00	.581	75	.821	-47	.110	-8	.643	-116
16800.00	.596	72	.810	-50	.112	-12	.642	-116
17000.00	.611	68	.806	-53	.112	-15	.604	-117
17200.00	.614	66	.770	-56	.114	-16	.581	-117
17400.00	.625	64	.776	-59	.116	-18	.576	-119
17600.00	.636	60	.768	-62	.120	-19	.573	-120
17800.00	.650	58	.753	-64	.124	-22	.550	-120
18000.00	.661	56	.758	-68	.129	-24	.517	-124

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48.

SEPT. 19, 1980

ONR PA PAC-2 #9
FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) #9 VD=4V ID=35.0MA

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.937	-33	2.095	150	.031	74	.836	-8
2200.000	.927	-36	2.094	147	.034	73	.834	-9
2400.000	.914	-40	2.095	144	.036	72	.830	-10
2600.000	.897	-44	2.097	140	.039	70	.827	-11
2800.000	.885	-48	2.088	137	.041	68	.819	-12
3000.000	.871	-53	2.085	134	.043	67	.813	-13
3200.000	.858	-57	2.074	131	.045	65	.814	-14
3400.000	.841	-61	2.049	127	.047	64	.806	-15
3600.000	.830	-65	2.025	124	.049	62	.802	-16
3800.000	.818	-69	2.014	121	.050	61	.799	-17
4000.000	.802	-73	1.987	118	.052	59	.794	-18
4200.000	.792	-77	1.944	115	.052	58	.798	-19
4400.000	.777	-80	1.912	112	.053	57	.792	-20
4600.000	.763	-84	1.894	109	.054	55	.789	-21
4800.000	.746	-88	1.879	106	.055	54	.788	-22
5000.000	.732	-92	1.860	103	.056	53	.782	-22
5200.000	.716	-96	1.834	100	.057	51	.779	-23
5400.000	.699	-101	1.806	97	.057	49	.780	-24
5600.000	.678	-106	1.792	93	.059	46	.768	-25
5800.000	.656	-111	1.750	90	.060	40	.755	-26
6000.000	.610	-117	1.677	86	.054	30	.735	-26
6200.000	.571	-115	1.581	86	.035	30	.732	-24
6400.000	.593	-118	1.614	85	.035	52	.753	-25
6600.000	.596	-123	1.627	82	.041	57	.761	-26
6800.000	.594	-128	1.622	80	.045	56	.758	-27
7000.000	.588	-133	1.597	77	.046	56	.756	-28
7200.000	.581	-138	1.577	74	.046	56	.754	-29
7400.000	.577	-143	1.557	71	.047	56	.749	-30
7600.000	.575	-148	1.527	68	.047	56	.750	-31
7800.000	.579	-152	1.509	66	.047	57	.745	-31
8000.000	.579	-156	1.469	63	.047	58	.743	-33
8200.000	.584	-160	1.436	60	.047	59	.753	-33
8400.000	.584	-164	1.410	58	.047	60	.747	-34
8600.000	.587	-167	1.396	56	.048	60	.741	-36
8800.000	.586	-170	1.377	54	.048	61	.739	-37
9000.000	.586	-173	1.354	51	.049	61	.737	-37
9200.000	.583	-177	1.343	49	.050	62	.738	-38
9400.000	.585	179	1.321	46	.051	63	.733	-39
9600.000	.590	176	1.306	44	.052	63	.729	-41
9800.000	.592	173	1.283	41	.054	62	.729	-43
10000.00	.594	170	1.258	39	.054	62	.735	-45
10200.00	.590	167	1.238	37	.056	62	.733	-46
10400.00	.597	164	1.224	35	.057	61	.734	-48
[illegible]	.604	162	1.206	32	.058	60	.735	-50
[illegible]	.600	161	1.191	30	.059	[illegible]	.732	-52
[illegible]	[illegible]	159	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	156	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	152	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	149	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	146	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	141	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.565	137	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12400.00	.568	133	1.074	11	.069	51	.736	-61
12600.00	.571	131	1.067	8	.070	49	.737	-61
12800.00	.560	127	1.057	6	.071	47	.742	-63
13000.00	.548	122	1.046	3	.073	45	.747	-63
13200.00	.549	118	1.040	1	.075	43	.747	-64
13400.00	.553	113	1.034	-2	.076	41	.739	-64
13600.00	.554	108	1.029	-5	.078	38	.739	-66
13800.00	.554	103	1.016	-8	.079	35	.746	-67
14000.00	.562	96	1.012	-12	.082	32	.735	-69
14200.00	.561	90	.971	-14	.082	30	.717	-70
14400.00	.578	87	.968	-18	.084	27	.715	-72
14600.00	.586	84	.941	-21	.085	24	.713	-74
14800.00	.599	80	.929	-23	.087	21	.716	-76
15000.00	.618	77	.908	-26	.089	18	.719	-77
15200.00	.629	75	.894	-28	.090	16	.707	-79
15400.00	.631	72	.881	-32	.091	13	.706	-81
15600.00	.613	67	.860	-34	.092	11	.714	-82
15800.00	.606	62	.848	-38	.094	8	.716	-82
16000.00	.626	58	.829	-40	.096	6	.714	-82
16200.00	.636	54	.819	-44	.097	2	.694	-83
16400.00	.639	51	.786	-46	.099	1	.684	-85
16600.00	.639	47	.768	-49	.101	-2	.681	-86
16800.00	.655	45	.748	-50	.103	-3	.674	-87
17000.00	.686	43	.754	-52	.106	-6	.644	-89
17200.00	.704	44	.717	-54	.108	-7	.619	-91
17400.00	.712	44	.729	-56	.111	-10	.615	-94
17600.00	.718	43	.731	-59	.114	-11	.613	-97
17800.00	.733	42	.728	-61	.117	-13	.608	-99
18000.00	.735	40	.737	-66	.120	-16	.588	-102

REF PLANE EXT(CM): IN= 5.48, OUT= 5.48

APPENDIX B

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) LC CKT #10 X 3

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.774	-166	.366	-47	.366	-47	.774	-166
2200.000	.801	-174	.268	-42	.269	-42	.801	-174
2400.000	.820	178	.194	-26	.194	-27	.820	178
2600.000	.817	171	.174	1	.173	1	.818	171
2800.000	.810	164	.210	23	.210	23	.811	164
3000.000	.796	157	.272	34	.272	34	.796	157
3200.000	.776	152	.337	37	.337	37	.776	152
3400.000	.756	146	.398	38	.398	38	.756	146
3600.000	.734	142	.445	37	.445	37	.734	142
3800.000	.711	137	.494	36	.494	36	.711	137
4000.000	.690	134	.537	35	.537	35	.690	134
4200.000	.686	131	.579	33	.579	33	.686	131
4400.000	.675	128	.613	32	.613	32	.675	128
4600.000	.661	126	.644	30	.643	30	.661	126
4800.000	.645	124	.671	28	.670	28	.645	124
5000.000	.624	122	.696	26	.696	26	.624	122
5200.000	.602	121	.716	24	.716	24	.602	121
5400.000	.580	120	.731	23	.732	23	.580	120
5600.000	.561	118	.748	21	.748	21	.561	118
5800.000	.541	117	.756	20	.756	20	.541	117
6000.000	.521	116	.769	18	.769	18	.521	116
6200.000	.501	114	.778	17	.778	17	.501	114
6400.000	.482	111	.787	16	.786	16	.483	111
6600.000	.468	108	.795	15	.796	15	.468	108
6800.000	.458	106	.808	14	.807	14	.458	106
7000.000	.448	103	.813	13	.813	13	.448	103
7200.000	.442	101	.828	12	.827	12	.442	101
7400.000	.441	99	.838	11	.838	11	.441	99
7600.000	.438	99	.846	10	.845	10	.438	99
7800.000	.435	98	.852	8	.852	8	.435	98
8000.000	.438	99	.855	7	.856	7	.438	99
8200.000	.453	99	.858	4	.858	4	.453	99
8400.000	.453	99	.853	3	.853	3	.453	99
8600.000	.454	99	.837	3	.838	3	.454	99
8800.000	.455	98	.833	2	.833	2	.455	98
9000.000	.446	97	.829	2	.829	2	.446	97
9200.000	.432	95	.822	1	.822	1	.432	95
9400.000	.425	91	.821	0	.822	0	.425	91
9600.000	.423	88	.819	1	.819	1	.423	88
9800.000	.421	83	.827	1	.826	1	.422	83
10000.00	.421	79	.842	1	.842	1	.421	79
10200.00	.391	77	.865	0	.865	0	.391	77
10400.00	.379	75	.884	-1	.885	-1	.379	75
10600.00	.379	76	.887	-2	.888	-2	.380	76
10800.00	.384	78	.895	-4	.896	-4	.384	78
[illegible]	.392	81	.896	-5	.896	-5	.391	81
[illegible]	.407	85	[illegible]	-7	[illegible]	-7	.407	85
[illegible]	.434	89	[illegible]	-9	[illegible]	-9	.434	89
[illegible]	[illegible]	92	.867	-10	.868	-10	.430	92
[illegible]	.472	93	.841	-11	.841	-11	.471	93
[illegible]	.461	93	.883	-11	.883	-11	.462	93
12200.00	.433	92	.796	-8	.797	-8	.434	92

12400.00	.376	91	.792	-6	.784	-7	.371	91
12600.00	.345	81	.898	-4	.899	-4	.344	81
12800.00	.248	82	.921	-7	.923	-7	.248	82
13000.00	.197	88	.931	-9	.931	-9	.197	88
13200.00	.185	90	.927	-12	.927	-12	.185	90
13400.00	.186	84	.924	-12	.924	-12	.186	84
13600.00	.197	75	.910	-14	.908	-14	.198	75
13800.00	.218	68	.922	-15	.923	-15	.218	68
14000.00	.250	64	.906	-15	.906	-15	.249	64
14200.00	.277	65	.914	-17	.914	-17	.276	65
14400.00	.312	66	.891	-18	.891	-18	.312	67
14600.00	.377	71	.886	-19	.886	-19	.377	71
14800.00	.419	71	.845	-19	.844	-19	.418	71
15000.00	.418	70	.857	-18	.857	-18	.418	70
15200.00	.382	70	.868	-17	.868	-17	.382	70
15400.00	.321	68	.903	-17	.903	-17	.321	68
15600.00	.222	67	.941	-19	.941	-19	.222	67
15800.00	.138	79	.943	-22	.941	-22	.138	80
16000.00	.115	109	.951	-23	.950	-23	.115	109
16200.00	.148	122	.970	-25	.969	-25	.148	123
16400.00	.181	107	.945	-28	.945	-28	.181	107
16600.00	.212	91	.937	-31	.938	-31	.212	91
16800.00	.227	70	.900	-30	.901	-31	.227	70
17000.00	.273	60	.884	-32	.082	-32	.273	60
17200.00	.309	52	.065	-32	.866	-32	.309	52
17400.00	.344	47	.873	-33	.874	-33	.344	47
17600.00	.370	45	.847	-34	.848	-33	.371	45
17800.00	.394	44	.878	-34	.879	-34	.395	44
18000.00	.397	45	.851	-36	.845	-36	.392	45

REF PLANE EXT(CM): IN= 4.74, OUT= 4.74

PAGE 1: 1 JUNE 10/80

ONR FET CHARACTERIZATION

.00 VOLTS, .00 MA (MEAS 1) LC CKT #11

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.212	-102	.937	-15	.937	-15	.212	-102
2200.000	.233	-105	.921	-17	.921	-17	.233	-105
2400.000	.256	-110	.907	-19	.908	-19	.256	-110
2600.000	.287	-116	.883	-22	.882	-22	.287	-116
2800.000	.322	-123	.843	-25	.843	-25	.322	-123
3000.000	.367	-131	.794	-29	.794	-29	.367	-131
3200.000	.425	-142	.715	-32	.716	-32	.426	-142
3400.000	.486	-154	.612	-35	.612	-35	.486	-154
3600.000	.542	-167	.487	-34	.487	-34	.542	-167
3800.000	.586	178	.383	-24	.384	-24	.587	178
4000.000	.606	165	.353	-4	.353	-4	.607	165
4200.000	.619	155	.412	11	.413	12	.620	155
4400.000	.608	145	.497	18	.497	18	.609	145
4600.000	.587	138	.585	19	.586	19	.588	138
4800.000	.560	133	.654	17	.654	17	.560	133
5000.000	.529	129	.708	16	.708	16	.529	129
5200.000	.497	127	.751	14	.752	14	.498	127
5400.000	.466	126	.781	12	.781	12	.466	126
5600.000	.439	125	.797	10	.798	10	.440	125
5800.000	.415	124	.820	9	.820	9	.415	124
6000.000	.388	124	.837	7	.837	7	.388	124
6200.000	.362	122	.856	6	.855	6	.362	122
6400.000	.335	121	.865	6	.865	6	.336	121
6600.000	.314	118	.887	4	.888	4	.314	118
6800.000	.294	116	.880	4	.882	4	.294	116
7000.000	.277	114	.902	2	.902	2	.277	114
7200.000	.264	112	.903	0	.904	0	.264	112
7400.000	.256	111	.911	-0	.911	-0	.256	111
7600.000	.252	111	.920	-1	.921	-1	.252	111
7800.000	.249	111	.914	-2	.914	-2	.249	111
8000.000	.250	112	.926	-3	.927	-3	.251	112
8200.000	.261	112	.924	-4	.923	-4	.261	112
8400.000	.263	112	.944	-6	.944	-6	.263	112
8600.000	.261	109	.917	-6	.918	-6	.262	109
8800.000	.258	105	.930	-7	.930	-7	.258	105
9000.000	.243	102	.921	-8	.920	-8	.243	102
9200.000	.226	97	.919	-8	.919	-8	.226	97
9400.000	.213	88	.916	-9	.916	-9	.213	88
9600.000	.212	78	.921	-9	.920	-9	.212	78
9800.000	.212	67	.925	-9	.924	-9	.212	67
10000.00	.210	57	.935	-10	.935	-10	.210	57
10200.00	.175	50	.943	-11	.944	-11	.175	50
10400.00	.162	48	.954	-12	.954	-12	.162	48
10600.00	.160	51	.950	-13	.950	-13	.159	51
10800.00	.164	58	.954	-14	.953	-14	.164	58
11000.00	.173	67	.950	-15	.948	-15	.172	67
[illegible]	[illegible]	78	.955	-16	.955	-16	.193	78
[illegible]	[illegible]	84	[illegible]	-17	[illegible]	-17	.238	84
[illegible]	[illegible]	87	.940	-18	[illegible]	-18	.263	87
[illegible]	[illegible]	88	[illegible]	-19	.917	-19	.260	88
[illegible]	.272	85	.898	-18	.898	-18	.272	85
12200.00	.240	80	.903	-17	.903	-17	.240	80

12400.00	.173	70	.911	-17	.908	-17	.172	70
12600.00	.090	40	.970	-18	.970	-18	.090	40
12800.00	.013	-84	.957	-20	.957	-20	.013	-85
13000.00	.056	-148	.956	-20	.956	-20	.056	-148
13200.00	.062	-164	.957	-22	.956	-22	.062	-164
13400.00	.042	-175	.958	-22	.958	-22	.042	-175
13600.00	.018	140	.948	-23	.949	-23	.018	140
13800.00	.035	72	.956	-24	.956	-24	.034	72
14000.00	.069	65	.955	-25	.954	-25	.069	65
14200.00	.101	71	.950	-26	.950	-26	.101	71
14400.00	.147	76	.945	-27	.946	-27	.147	76
14600.00	.223	81	.943	-28	.943	-28	.223	81
14800.00	.267	79	.920	-29	.919	-29	.267	79
15000.00	.249	77	.916	-29	.915	-29	.249	77
15200.00	.198	82	.919	-29	.919	-29	.198	82
15400.00	.120	97	.925	-30	.924	-30	.120	97
15600.00	.102	146	.908	-30	.907	-30	.102	147
15800.00	.161	179	.929	-31	.930	-31	.161	179
16000.00	.217	178	.904	-30	.903	-30	.217	178
16200.00	.263	176	.976	-30	.975	-30	.263	176
16400.00	.246	162	.953	-33	.954	-33	.246	162
16600.00	.219	147	.981	-35	.981	-35	.219	147
16800.00	.153	130	.945	-36	.944	-36	.153	130
17000.00	.145	105	.937	-38	.937	-38	.145	105
17200.00	.144	81	.932	-40	.932	-40	.144	81
17400.00	.154	68	.911	-39	.912	-39	.154	68
17600.00	.173	60	.916	-40	.916	-39	.173	60
17800.00	.180	56	.908	-42	.907	-42	.180	56
18000.00	.188	57	.911	-42	.907	-42	.186	57

REF PLANE EXT(CM): IN= 4.74, OUT= 4.74

ONR-38 2.5 TURN #1

19:55:49 3 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.716	-174.4	.491	-12.5	.491	-12.5	.716	-174.4
2100.0000	.712	-172.8	.461	-14.8	.461	-14.8	.713	-172.8
2200.0000	.725	-172.3	.481	-12.0	.481	-11.9	.729	-172.5
2300.0000	.751	-172.0	.522	-15.3	.522	-15.3	.751	-171.8
2400.0000	.761	-174.8	.475	-23.3	.474	-23.3	.765	-174.7
2500.0000	.752	-173.5	.427	-22.3	.428	-22.2	.757	-173.5
2600.0000	.745	-176.2	.437	-23.9	.437	-24.0	.750	-176.1
2700.0000	.759	-174.3	.397	-31.6	.397	-31.5	.759	-174.3
2800.0000	.782	-177.7	.338	-27.8	.338	-27.8	.786	-177.6
2900.0000	.809	-177.4	.326	-21.5	.326	-21.7	.814	-177.5
3000.0000	.822	179.4	.286	-25.2	.286	-25.1	.825	179.4
3100.0000	.821	178.0	.219	-15.7	.219	-15.8	.821	177.9
3200.0000	.817	176.3	.255	-1.0	.255	-1.0	.818	176.3
3300.0000	.812	174.3	.280	-3.9	.280	-4.0	.815	174.4
3400.0000	.800	173.7	.250	5.0	.250	5.0	.805	173.6
3500.0000	.779	171.1	.285	14.6	.285	14.5	.779	171.1
3600.0000	.756	172.2	.334	9.5	.334	9.4	.758	172.1
3700.0000	.758	170.1	.301	6.5	.301	6.5	.758	170.1
3800.0000	.767	170.9	.315	14.9	.315	15.0	.769	170.9
3900.0000	.774	169.3	.400	10.7	.400	10.6	.774	169.3
4000.0000	.757	169.2	.348	6.1	.349	6.1	.757	169.1
4100.0000	.730	168.5	.323	12.7	.323	12.7	.730	168.6
4200.0000	.710	168.2	.394	10.8	.394	10.7	.710	168.2
4300.0000	.724	168.0	.379	4.3	.379	4.3	.728	167.9
4400.0000	.752	169.5	.357	12.5	.357	12.5	.755	169.5
4500.0000	.768	172.8	.445	14.3	.445	14.2	.772	172.7
4600.0000	.762	171.7	.417	1.4	.417	1.4	.762	171.7
4700.0000	.735	169.7	.362	6.1	.362	6.2	.736	169.6
4800.0000	.723	170.8	.409	12.7	.409	12.7	.725	170.8
4900.0000	.729	172.0	.422	1.6	.422	1.6	.729	171.9
5000.0000	.750	175.3	.390	7.3	.390	7.3	.752	175.2

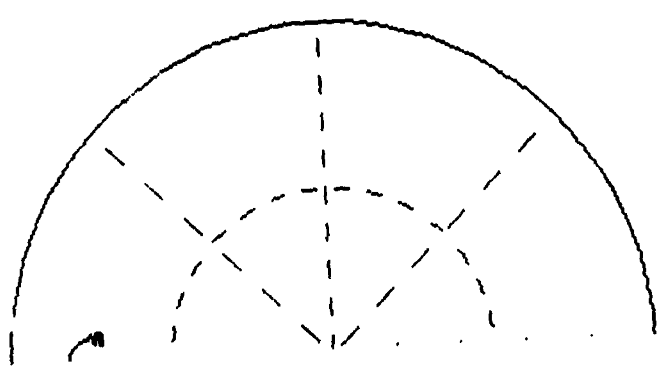
INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM

ONR-38 2.5 TURNS #1 19:23:13 3 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.715	-174.7	.489	-9.6	.489	-9.8	.716	-174.8
2100.0000	.717	-171.9	.456	-13.3	.456	-13.4	.722	-172.0
2200.0000	.718	-175.4	.466	-11.1	.466	-11.3	.723	-175.5
2300.0000	.731	-171.1	.492	-13.3	.492	-13.5	.731	-170.9
2400.0000	.746	-175.1	.453	-20.0	.453	-20.1	.746	-175.0
2500.0000	.753	-171.6	.420	-19.3	.420	-19.4	.753	-171.5
2600.0000	.763	-175.4	.440	-21.7	.440	-21.8	.763	-175.4
2700.0000	.784	-172.0	.403	-29.7	.401	-29.8	.785	-172.1
2800.0000	.803	-176.8	.337	-26.9	.337	-27.0	.807	-176.7
2900.0000	.817	-176.0	.319	-21.0	.319	-21.1	.821	-176.1
3000.0000	.824	-178.8	.280	-24.3	.280	-24.4	.825	-178.8
3100.0000	.822	179.5	.216	-15.1	.216	-15.1	.826	179.4
3200.0000	.817	177.9	.250	.1	.251	.1	.817	177.9
3300.0000	.806	176.2	.275	-2.4	.275	-2.7	.806	176.2
3400.0000	.797	175.4	.248	6.9	.247	6.7	.797	175.3
3500.0000	.786	174.8	.286	17.0	.286	16.9	.786	174.8
3600.0000	.772	174.3	.341	12.0	.342	11.9	.772	174.2
3700.0000	.764	174.4	.302	9.1	.302	9.1	.764	174.5
3800.0000	.756	172.9	.309	17.2	.309	17.0	.759	172.8
3900.0000	.750	174.9	.385	13.7	.385	13.7	.750	175.0
4000.0000	.746	172.4	.350	9.4	.351	9.4	.746	172.3
4100.0000	.741	175.4	.335	16.7	.335	16.6	.741	175.4
4200.0000	.736	172.3	.418	14.0	.418	13.8	.736	172.3
4300.0000	.730	174.7	.386	7.0	.386	7.0	.730	174.7
4400.0000	.731	172.5	.351	14.6	.351	14.6	.731	172.4
4500.0000	.724	174.9	.413	15.6	.413	15.6	.725	174.9
4600.0000	.723	173.1	.404	3.9	.404	3.9	.723	173.1
4700.0000	.718	174.2	.364	10.3	.364	10.4	.722	174.2
4800.0000	.721	174.1	.417	15.6	.417	15.6	.725	173.9
4900.0000	.719	173.6	.416	4.8	.417	4.8	.719	173.6
5000.0000	.717	174.9	.372	9.6	.373	9.5	.718	174.9

INPUT REF = 4.74 CM OUTPUT REF = 4.74 CM

ONR-38 2.5 TURNS #1



ONR-38 2.5 TURNS #2

19:39:58 3 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.575	-147.5	1.013	-37.6	1.011	-37.7	.575	-147.6
2100.0000	.600	-152.1	.936	-42.2	.936	-42.3	.600	-152.1
2200.0000	.634	-154.3	.851	-38.8	.850	-38.9	.638	-154.4
2300.0000	.680	-159.4	.827	-38.4	.827	-38.5	.683	-159.3
2400.0000	.709	-165.9	.705	-45.0	.703	-45.0	.712	-165.8
2500.0000	.713	-170.3	.550	-39.8	.550	-40.2	.717	-170.3
2600.0000	.707	-177.7	.505	-31.8	.504	-31.9	.711	-177.9
2700.0000	.708	179.8	.442	-27.9	.442	-28.1	.712	179.8
2800.0000	.719	172.6	.384	-10.9	.384	-11.0	.723	172.6
2900.0000	.734	169.2	.428	7.0	.427	6.9	.734	169.1
3000.0000	.735	163.6	.470	9.8	.470	9.7	.735	163.6
3100.0000	.725	159.4	.450	19.0	.450	18.9	.725	159.4
3200.0000	.717	155.3	.594	27.9	.594	27.8	.717	155.4
3300.0000	.707	150.6	.680	21.0	.680	20.9	.712	150.6
3400.0000	.699	147.0	.655	26.9	.655	26.8	.699	147.1
3500.0000	.673	143.3	.769	33.2	.768	33.1	.674	143.4
3600.0000	.643	139.8	.879	27.0	.879	26.9	.644	139.8
3700.0000	.645	138.4	.814	25.1	.814	24.9	.646	138.5
3800.0000	.658	133.8	.882	30.8	.882	30.6	.658	133.9
3900.0000	.666	132.6	1.000	24.0	1.000	23.8	.666	132.6
4000.0000	.639	125.9	.956	22.3	.956	22.4	.641	125.9
4100.0000	.614	127.0	.937	28.1	.937	28.0	.615	126.9
4200.0000	.584	123.8	1.016	24.2	1.016	24.2	.586	123.8
4300.0000	.569	125.6	1.016	19.3	1.016	19.3	.569	125.6
4400.0000	.599	124.3	1.024	24.9	1.024	24.8	.599	124.3
4500.0000	.593	128.7	1.042	21.2	1.042	21.1	.593	128.5
4600.0000	.605	125.8	1.026	13.8	1.026	13.7	.608	125.8
4700.0000	.559	123.0	1.013	19.0	1.013	19.0	.561	123.0
4800.0000	.525	124.7	1.010	21.0	1.010	21.0	.525	124.7
4900.0000	.519	126.0	1.013	13.1	1.013	13.1	.519	125.9
5000.0000	.541	127.2	1.040	16.7	1.040	16.7	.541	127.2

INPUT REF = 4.74 CM OUTPUT REF = 4.74 CM

COIL # 1 ONR-38

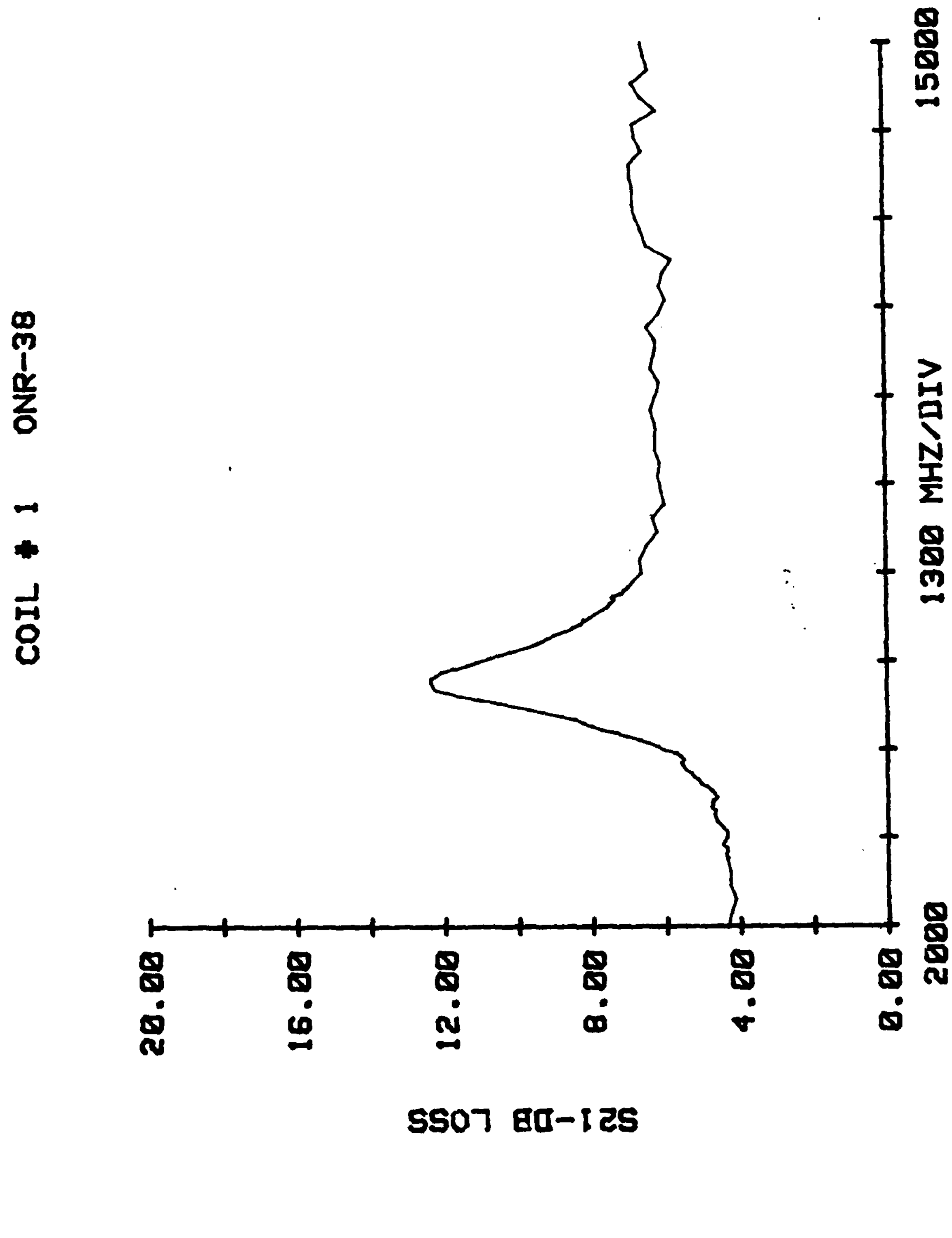
13:26:8 16 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.397	-166.9	.606	-9.6	.606	-9.6	.397	-166.9
2200.0000	.392	-165.0	.613	-9.3	.611	-9.3	.393	-165.2
2400.0000	.395	-166.9	.622	-10.8	.620	-10.7	.397	-166.7
2600.0000	.387	-168.4	.611	-12.8	.611	-12.9	.387	-168.5
2800.0000	.387	-168.5	.612	-13.2	.612	-13.3	.388	-168.3
3000.0000	.397	-168.0	.606	-15.0	.606	-15.0	.399	-168.1
3000.0000	.398	-167.9	.607	-15.0	.607	-15.0	.400	-168.1
3050.0000	.400	-167.7	.603	-15.4	.603	-15.3	.402	-167.9
3100.0000	.403	-166.6	.606	-16.2	.606	-16.3	.403	-166.9
3150.0000	.406	-166.5	.606	-17.4	.606	-17.4	.406	-166.7
3200.0000	.410	-166.8	.598	-17.8	.598	-17.9	.411	-166.9
3200.0000	.410	-166.9	.598	-17.8	.598	-17.7	.411	-166.9
3250.0000	.414	-167.2	.601	-18.2	.601	-18.2	.414	-167.2
3300.0000	.418	-166.8	.605	-18.4	.605	-18.4	.420	-166.9
3350.0000	.421	-166.6	.606	-18.7	.604	-18.7	.421	-166.9
3400.0000	.426	-166.5	.605	-19.4	.605	-19.3	.426	-166.7
3400.0000	.426	-166.5	.605	-19.4	.605	-19.3	.426	-166.8
3450.0000	.426	-167.2	.598	-19.9	.598	-19.9	.426	-167.4
3500.0000	.429	-168.1	.593	-20.2	.591	-20.1	.429	-168.3
3550.0000	.431	-167.8	.587	-20.5	.586	-20.5	.431	-168.0
3600.0000	.434	-166.7	.584	-20.7	.584	-20.7	.434	-166.9
3600.0000	.434	-166.7	.584	-20.7	.584	-20.7	.434	-166.9
3650.0000	.437	-167.1	.583	-21.2	.583	-21.1	.437	-167.1
3700.0000	.443	-168.0	.586	-21.9	.584	-21.8	.443	-168.1
3750.0000	.447	-167.9	.578	-22.1	.578	-22.1	.449	-168.1
3800.0000	.455	-166.7	.581	-22.2	.581	-22.1	.455	-167.0
3800.0000	.456	-166.7	.581	-22.2	.581	-22.1	.456	-167.1
3850.0000	.460	-167.0	.579	-22.0	.579	-22.1	.461	-167.3
3900.0000	.468	-169.0	.588	-22.5	.586	-22.6	.471	-169.2
3950.0000	.472	-169.3	.584	-23.2	.584	-23.1	.472	-169.5
4000.0000	.477	-168.2	.578	-24.6	.577	-24.5	.477	-168.5
4000.0000	.477	-163.4	.579	-24.6	.578	-24.6	.477	-168.6
4050.0000	.482	-167.5	.571	-24.9	.570	-24.8	.484	-167.7
4100.0000	.482	-169.3	.560	-26.3	.560	-26.2	.483	-169.4
4150.0000	.490	-170.9	.555	-27.1	.555	-27.0	.492	-171.0
4200.0000	.495	-169.7	.548	-27.9	.548	-27.9	.495	-169.8
4200.0000	.494	-169.8	.548	-27.8	.548	-27.8	.494	-169.9
4250.0000	.507	-169.8	.544	-29.1	.544	-29.1	.507	-170.1
4300.0000	.518	-170.5	.534	-30.2	.534	-30.2	.518	-170.6
4350.0000	.532	-170.9	.531	-30.4	.530	-30.4	.532	-171.1
4400.0000	.547	-169.5	.526	-30.8	.526	-30.8	.549	-169.6
4400.0000	.548	-169.6	.527	-30.9	.526	-30.9	.550	-169.8
4450.0000	.565	-167.4	.530	-31.0	.530	-31.0	.569	-167.6
4500.0000	.574	-166.4	.526	-32.5	.523	-32.5	.577	-166.4
4550.0000	.593	-168.1	.519	-34.1	.519	-34.0	.595	-168.2
4600.0000	.599	-168.2	.499	-35.5	.499	-35.5	.599	-168.3
4600.0000	.599	-168.3	.499	-35.5	.499	-35.5	.599	-168.3
4650.0000	.609	-169.1	.490	-36.7	.490	-36.7	.609	-169.2
4700.0000	.619	-170.6	.475	-38.2	.475	-38.1	.619	-170.7
4750.0000	.625	-171.6	.463	-39.9	.463	-39.9	.627	-171.8
4800.0000	.635	-172.1	.445	-40.7	.445	-40.6	.635	-172.3
4300.0000	.635	-172.1	.445	-40.7	.445	-40.7	.635	-172.2
4850.0000	.647	-171.6	.431	-41.6	.430	-41.6	.647	-171.7
4900.0000	.657	-170.5	.411	-41.8	.411	-41.7	.657	-170.7
4950.0000	.678	-169.2	.399	-40.3	.399	-40.2	.678	-169.4
5000.0000	.693	-169.7	.389	-40.1	.387	-39.9	.693	-169.8
5000.0000	.693	-169.6	.389	-39.9	.388	-39.9	.693	-169.7

5050.0000	.707	-170.5	.379	-39.7	.379	-39.6	.707	-170.6
5100.0000	.726	-171.5	.362	-39.7	.362	-39.7	.726	-171.7
5150.0000	.733	-171.8	.345	-39.8	.345	-39.7	.733	-172.1
5200.0000	.739	-172.8	.328	-38.2	.328	-38.2	.739	-172.9
5200.0000	.739	-172.8	.328	-38.1	.328	-38.2	.739	-172.9
5250.0000	.735	-175.5	.312	-38.2	.312	-38.3	.738	-175.7
5300.0000	.734	-178.3	.299	-37.7	.299	-37.7	.734	-178.5
5350.0000	.730	-178.2	.280	-36.0	.280	-36.0	.730	-178.4
5400.0000	.723	-178.7	.265	-34.1	.265	-34.1	.723	-178.9
5400.0000	.724	-178.7	.265	-34.3	.265	-34.2	.723	-178.9
5450.0000	.720	178.2	.253	-30.5	.253	-30.6	.720	178.1
5500.0000	.714	175.0	.244	-26.2	.244	-26.1	.713	174.9
5550.0000	.713	175.1	.243	-21.9	.242	-21.8	.711	174.9
5600.0000	.716	176.0	.242	-17.0	.242	-16.8	.716	175.8
5600.0000	.716	175.9	.242	-16.9	.242	-16.8	.716	175.7
5650.0000	.708	174.4	.241	-13.8	.241	-13.8	.708	174.2
5700.0000	.711	172.2	.245	-9.4	.246	-9.3	.709	172.0
5750.0000	.703	171.2	.249	-6.1	.249	-6.0	.699	171.0
5800.0000	.691	172.3	.259	-3.2	.259	-3.1	.690	172.0
5800.0000	.691	172.3	.259	-3.2	.259	-3.2	.690	172.0
5850.0000	.686	170.3	.271	-1.9	.271	-1.7	.683	170.1
5900.0000	.671	167.0	.278	-1.0	.280	-1.1	.667	166.8
5950.0000	.659	165.8	.289	.5	.289	.5	.659	165.5
6000.0000	.651	166.4	.298	2.5	.298	2.5	.650	166.1
6000.0000	.653	166.3	.298	2.3	.298	2.5	.651	166.1
6050.0000	.639	165.1	.310	3.2	.310	3.2	.638	164.8
6100.0000	.633	164.0	.323	4.2	.323	4.1	.630	163.7
6150.0000	.624	163.8	.333	5.2	.333	5.0	.624	163.4
6200.0000	.617	164.7	.342	4.9	.342	4.9	.614	164.4
6200.0000	.617	164.6	.342	5.0	.342	5.1	.614	164.3
6250.0000	.609	164.1	.349	5.1	.349	5.0	.607	163.8
6300.0000	.601	163.5	.356	4.9	.357	4.9	.598	163.3
6350.0000	.595	164.0	.368	4.8	.368	4.8	.592	163.7
6400.0000	.583	163.6	.376	4.7	.376	4.6	.583	163.3
6400.0000	.583	163.5	.376	4.5	.376	4.5	.583	163.2
6450.0000	.575	162.7	.386	3.6	.386	3.6	.575	162.4
6500.0000	.568	162.9	.389	3.7	.389	3.7	.566	162.5
6550.0000	.562	163.8	.397	3.5	.397	3.4	.561	163.4
6600.0000	.554	164.1	.403	3.8	.403	3.7	.554	163.8
6600.0000	.553	164.1	.403	3.8	.403	3.8	.553	163.8
6650.0000	.545	162.0	.411	3.3	.411	3.2	.544	161.7
6700.0000	.537	162.8	.418	2.8	.418	2.8	.537	162.6
6750.0000	.530	165.3	.423	2.3	.423	2.2	.530	165.0
6800.0000	.525	164.7	.428	2.3	.428	2.3	.525	164.5
6800.0000	.525	164.8	.428	2.4	.428	2.3	.525	164.5
6850.0000	.516	162.4	.425	1.4	.425	1.4	.516	162.1
6900.0000	.516	162.9	.438	2.0	.438	2.1	.510	163.1
6950.0000	.510	164.2	.442	1.3	.442	1.3	.504	164.6
7000.0000	.507	163.8	.447	.4	.447	.4	.502	164.1
7000.0000	.507	163.8	.447	.3	.447	.3	.503	164.2
7200.0000	.496	167.2	.467	.5	.467	.4	.490	167.4
7400.0000	.479	167.0	.465	-.9	.465	-1.0	.476	166.9
7600.0000	.476	168.0	.475	-3.3	.475	-3.4	.474	167.7
7800.0000	.471	168.9	.491	-5.2	.491	-5.3	.471	168.7
8000.0000	.443	170.6	.484	-6.1	.484	-6.1	.445	170.5
8200.0000	.446	169.7	.502	-9.2	.502	-9.3	.451	169.9
8400.0000	.425	168.3	.498	-11.4	.498	-11.6	.430	168.8
8600.0000	.405	168.1	.493	-11.1	.493	-11.2	.410	169.2
8800.0000	.398	166.3	.495	-11.7	.495	-11.7	.403	168.0
9000.0000	.398	167.3	.489	-12.2	.489	-12.2	.401	169.3
9200.0000	.397	167.3	.489	-13.7	.491	-13.7	.396	169.9
9400.0000	.400	168.1	.488	-14.0	.489	-14.0	.396	170.8
9600.0000	.401	168.8	.482	-14.4	.483	-14.5	.394	171.4
9800.0000	.406	169.3	.490	-15.7	.491	-15.8	.397	171.5
10000.0000	.408	170.9	.495	-15.9	.497	-16.0	.397	172.6
10200.0000	.412	171.3	.483	-15.7	.483	-15.8	.401	172.2

10400.0000	.425	176.0	.488	-15.2	.488	-15.2	.415	176.5
10600.0000	.426	178.1	.490	-16.5	.492	-16.6	.418	178.0
10800.0000	.409	-174.5	.477	-16.6	.477	-16.6	.405	-174.9
11000.0000	.420	-170.0	.496	-16.2	.497	-16.2	.420	-170.8
11200.0000	.410	-167.3	.506	-20.4	.506	-20.5	.411	-168.1
11400.0000	.373	-168.6	.497	-22.0	.497	-22.0	.380	-169.0
11600.0000	.357	-166.0	.504	-21.0	.504	-21.1	.368	-165.7
11800.0000	.364	-172.4	.516	-23.4	.518	-23.3	.379	-170.9
12000.0000	.386	-175.6	.477	-24.9	.478	-24.8	.399	-173.0
12200.0000	.423	-175.5	.472	-23.9	.472	-23.9	.426	-174.5
12400.0000	.427	-174.6	.462	-24.4	.464	-24.4	.430	-174.8
12600.0000	.420	-173.6	.458	-25.5	.459	-25.5	.422	-173.6
12800.0000	.422	-173.2	.459	-26.2	.459	-26.2	.424	-173.2
13000.0000	.426	-173.7	.455	-27.0	.455	-27.1	.427	-173.7
13200.0000	.440	-174.8	.454	-26.2	.454	-26.3	.443	-174.8
13400.0000	.447	-176.8	.472	-26.1	.472	-26.2	.449	-176.9
13600.0000	.455	-176.1	.461	-26.5	.462	-26.6	.455	-176.2
13800.0000	.461	-171.6	.459	-25.0	.459	-25.0	.463	-171.7
14000.0000	.491	-170.0	.494	-27.5	.494	-27.7	.494	-170.2
14200.0000	.460	-169.3	.471	-31.2	.471	-31.3	.461	-169.6
14400.0000	.431	-165.8	.459	-30.2	.460	-30.3	.432	-165.9
14600.0060	.433	-164.2	.483	-31.1	.483	-31.2	.433	-164.3
14800.0000	.414	-164.6	.476	-33.2	.476	-33.4	.414	-164.5
15000.0000	.414	-163.5	.472	-32.6	.472	-32.6	.412	-163.6

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM


COIL # 1 ONR-38
S21-DB LOSS
20.00
16.00
12.00
8.00
4.00
0.00
2000
1300 MHZ/DIV
15000

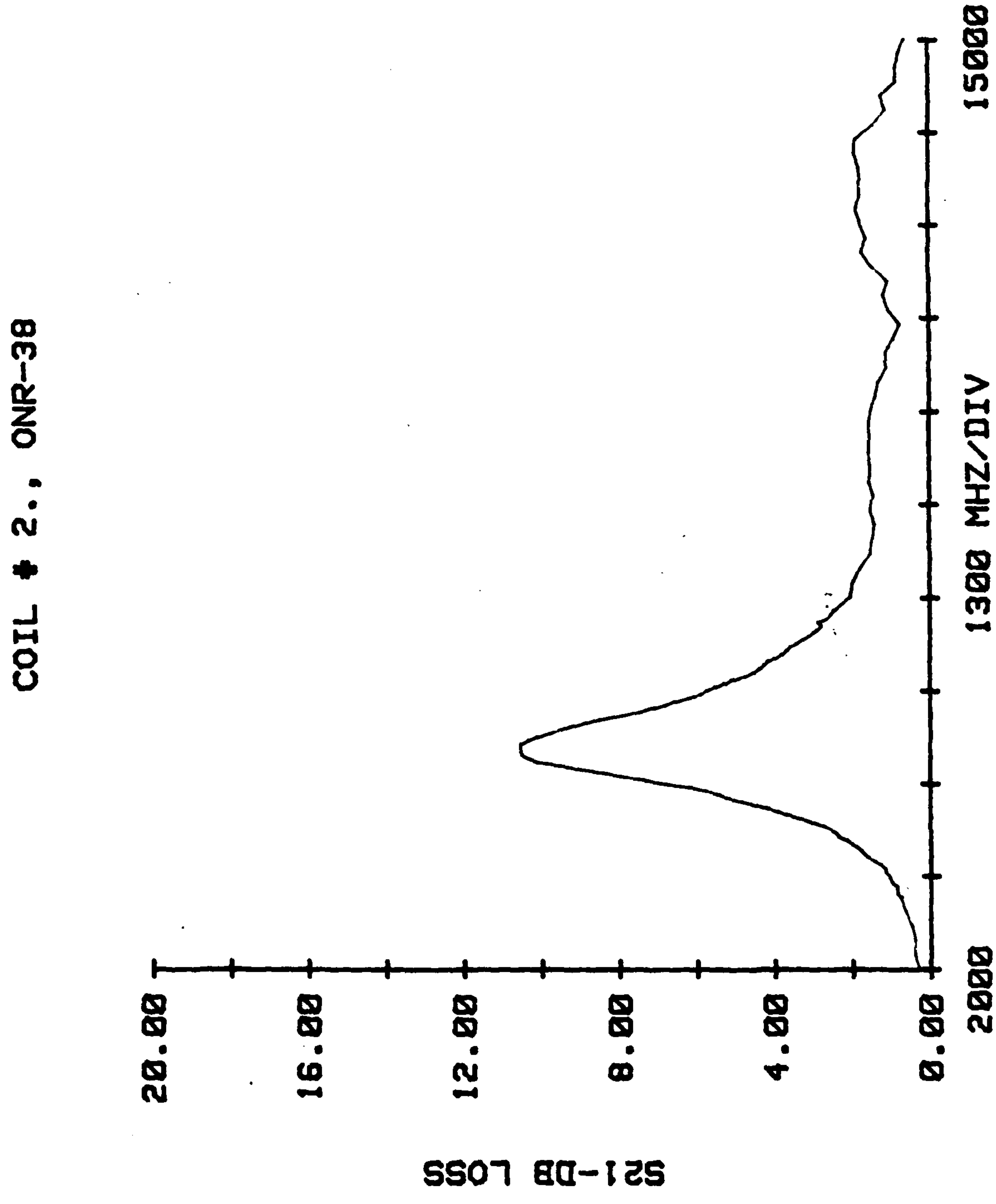
COIL # 2., ONR-38 11:17:25 16 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.171	-112.5	.968	-13.7	.962	-13.6	.172	-112.9
2200.0000	.185	-110.7	.955	-14.3	.953	-14.3	.186	-111.0
2400.0000	.197	-114.4	.957	-15.5	.954	-15.5	.197	-114.6
2600.0000	.202	-118.2	.948	-17.8	.948	-17.8	.202	-118.6
2800.0000	.208	-121.8	.930	-19.4	.930	-19.4	.209	-121.7
3000.0000	.232	-123.2	.916	-21.9	.910	-21.9	.232	-123.8
3000.0000	.232	-123.2	.918	-21.9	.912	-21.9	.232	-123.9
3050.0000	.239	-123.7	.907	-22.6	.904	-22.6	.240	-124.3
3100.0000	.247	-122.1	.907	-23.4	.903	-23.4	.248	-122.4
3150.0000	.257	-123.4	.907	-24.3	.901	-24.3	.257	-123.5
3200.0000	.266	-126.0	.895	-25.3	.895	-25.4	.267	-126.0
3200.0000	.266	-126.3	.895	-25.3	.895	-25.3	.267	-126.1
3250.0000	.274	-126.7	.890	-26.0	.890	-26.0	.275	-126.7
3300.0000	.287	-125.6	.885	-26.4	.884	-26.4	.287	-125.6
3350.0000	.295	-126.9	.877	-26.8	.877	-26.8	.295	-127.0
3400.0000	.307	-129.6	.875	-27.3	.875	-27.3	.307	-129.8
3400.0000	.307	-129.6	.875	-27.3	.875	-27.3	.307	-129.7
3450.0000	.316	-131.2	.865	-28.2	.860	-28.3	.316	-131.3
3500.0000	.327	-130.8	.850	-29.0	.850	-29.1	.328	-131.1
3550.0000	.338	-131.1	.835	-29.9	.833	-29.9	.338	-131.2
3600.0000	.348	-133.7	.823	-30.3	.821	-30.3	.348	-133.7
3600.9000	.348	-133.8	.823	-30.2	.822	-30.3	.348	-133.7
3650.0000	.359	-135.9	.815	-30.8	.811	-30.8	.359	-135.8
3700.0000	.372	-136.0	.806	-31.5	.806	-31.5	.372	-136.1
3750.0000	.383	-136.9	.793	-32.3	.789	-32.4	.383	-137.1
3800.0000	.396	-139.1	.781	-32.4	.777	-32.5	.396	-139.2
3800.0000	.397	-139.2	.782	-32.3	.777	-32.4	.397	-139.2
3850.0000	.411	-141.1	.763	-32.6	.761	-32.7	.412	-141.2
3900.0000	.423	-143.5	.757	-32.9	.757	-32.9	.423	-143.6
3950.0000	.438	-144.1	.746	-33.7	.742	-33.7	.438	-144.2
4000.0000	.447	-145.6	.731	-35.3	.727	-35.4	.447	-145.7
4000.0000	.447	-145.7	.732	-35.4	.728	-35.4	.447	-145.8
4050.0000	.464	-148.0	.706	-36.1	.702	-36.2	.464	-148.1
4100.0000	.471	-151.1	.682	-37.9	.680	-37.8	.471	-151.1
4150.0000	.488	-154.5	.658	-38.5	.658	-38.6	.488	-154.5
4200.0000	.497	-155.2	.637	-39.5	.637	-39.5	.497	-155.3
4200.0000	.496	-155.3	.637	-39.4	.637	-39.5	.496	-155.3
4250.0000	.514	-157.7	.618	-40.4	.618	-40.5	.514	-157.8
4300.0000	.534	-159.7	.593	-41.5	.593	-41.5	.534	-159.8
4350.0000	.551	-161.8	.571	-41.2	.568	-41.3	.551	-161.9
4400.0000	.573	-461.9	.548	-41.0	.547	-41.0	.572	-162.2
4400.0000	.573	-162.0	.548	-41.0	.547	-41.0	.571	-162.2
4450.0000	.593	-162.0	.533	-40.2	.533	-40.2	.593	-162.1
4500.0000	.606	-162.7	.514	-40.7	.511	-40.7	.606	-162.8
4550.0000	.627	-166.5	.491	-41.2	.490	-41.2	.627	-166.5
4600.0000	.634	-168.5	.455	-41.3	.455	-41.3	.633	-168.6
4600.0000	.634	-168.4	.455	-41.2	.455	-41.3	.631	-168.6
4650.0000	.644	-171.1	.432	-40.5	.432	-40.5	.644	-171.3
4700.0000	.651	-174.5	.402	-39.8	.402	-39.8	.651	-174.6
4750.0000	.655	-177.3	.380	-38.9	.379	-38.9	.654	-177.4
4800.0000	.659	-179.1	.355	-36.7	.355	-36.7	.656	-179.1
4800.0000	.659	-179.0	.355	-36.8	.355	-36.7	.656	-179.1
4850.0000	.664	179.5	.333	-34.1	.333	-34.1	.664	179.4
4900.0000	.670	178.6	.313	-30.3	.313	-30.3	.670	178.5
4950.0000	.685	178.8	.304	-24.5	.304	-24.4	.685	178.7
5000.0000	.697	177.6	.299	-19.7	.297	-19.7	.694	177.6
5000.0000	.697	177.7	.299	-19.5	.298	-19.6	.694	177.6

5050.0000	.706	175.1	.298	-14.9	.298	-14.9	.705	175.0
5100.0000	.714	172.0	.297	-10.5	.297	-10.4	.713	172.0
5150.0000	.713	170.3	.298	-6.2	.298	-6.3	.712	170.1
5200.0000	.710	169.2	.304	-1.0	.304	-1.1	.706	169.1
5200.0000	.710	169.2	.304	-.9	.304	-1.0	.706	169.1
5250.0000	.695	165.8	.312	1.9	.312	1.8	.695	165.7
5300.0000	.682	161.2	.325	4.3	.324	4.4	.682	161.1
5350.0000	.672	160.2	.334	7.4	.334	7.3	.669	160.1
5400.0000	.661	160.3	.346	9.3	.345	9.3	.661	160.1
5400.0000	.661	160.2	.345	9.3	.345	9.2	.661	160.1
5450.0000	.654	157.6	.361	12.2	.361	12.1	.654	157.5
5500.0000	.646	152.8	.377	14.9	.376	14.8	.643	152.8
5550.0000	.645	150.8	.400	16.5	.400	16.5	.645	150.7
5600.0000	.651	151.5	.423	18.6	.423	18.4	.650	151.4
5600.0000	.650	151.4	.423	18.4	.423	18.4	.650	151.4
5650.0000	.648	149.6	.436	18.8	.434	18.7	.645	149.5
5700.0000	.649	146.1	.457	20.0	.457	20.0	.649	145.9
5750.0000	.646	143.5	.470	20.7	.470	20.8	.644	143.4
5800.0000	.639	144.0	.491	21.0	.490	20.9	.638	143.9
5800.0000	.639	144.1	.491	21.0	.490	21.0	.639	143.9
5850.0000	.634	142.2	.507	20.3	.507	20.3	.630	142.1
5900.0000	.619	138.7	.516	19.5	.516	19.5	.619	138.6
5950.0000	.614	136.1	.531	19.5	.530	19.4	.613	136.0
6000.0000	.608	135.9	.545	20.1	.543	20.1	.605	135.8
6000.0000	.609	135.8	.546	20.1	.543	20.0	.606	135.7
6050.0000	.599	134.0	.557	19.8	.555	19.9	.597	134.0
6100.0000	.594	131.9	.579	19.8	.579	19.8	.594	131.8
6150.0000	.592	130.8	.594	20.0	.592	19.9	.592	130.7
6200.0000	.589	131.5	.604	19.4	.601	19.3	.586	131.5
6200.0000	.589	131.4	.604	19.4	.602	19.4	.586	131.4
6250.0000	.583	129.1	.613	19.3	.611	19.3	.579	129.0
6300.0000	.573	127.0	.619	18.9	.618	18.8	.573	126.9
6350.0000	.571	127.3	.633	18.5	.633	18.5	.571	127.3
6400.0000	.564	127.5	.647	18.2	.645	18.2	.561	127.5
6400.0000	.564	127.5	.646	18.0	.643	18.0	.561	127.5
6450.0000	.557	124.5	.655	17.0	.655	17.0	.554	124.5
6500.0000	.551	122.4	.662	17.0	.662	17.0	.549	122.3
6550.0000	.547	122.9	.674	16.5	.670	16.5	.544	122.9
6600.0000	.544	123.8	.686	16.5	.686	16.4	.541	123.8
6600.0000	.542	123.8	.685	16.6	.685	16.5	.540	123.8
6650.0000	.534	120.8	.698	15.8	.698	15.8	.534	120.7
6700.0000	.523	117.0	.709	15.1	.704	15.1	.520	116.9
6750.0000	.526	118.7	.717	14.6	.717	14.6	.523	118.6
6800.0000	.507	120.1	.726	14.4	.724	14.3	.506	120.1
6800.0000	.508	120.1	.727	14.4	.723	14.3	.507	120.1
6850.0000	.502	116.8	.719	14.1	.719	14.1	.500	116.8
6900.0000	.492	114.2	.739	14.1	.739	14.0	.489	114.2
6950.0000	.485	114.1	.746	13.3	.745	13.3	.485	114.0
7000.0000	.478	116.0	.752	12.5	.748	12.5	.476	116.0
7000.0000	.479	116.0	.751	12.5	.748	12.5	.477	116.0
7200.0000	.457	113.5	.791	11.8	.786	11.7	.454	113.4
7400.0000	.441	113.0	.799	11.2	.795	11.1	.441	112.9
7600.0000	.416	106.6	.814	8.8	.814	8.7	.416	106.6
7800.0000	.401	105.9	.840	6.0	.835	6.0	.400	105.9
8000.0000	.372	102.6	.847	5.0	.842	5.0	.372	102.5
8200.0000	.354	102.5	.852	.5	.851	.4	.354	102.4
8400.0000	.368	98.5	.841	-.9	.837	-1.0	.366	98.4
8600.0000	.383	97.6	.848	-.8	.845	-.9	.381	97.6
8800.0000	.398	92.4	.838	-1.8	.837	-1.9	.398	92.3
9000.0000	.405	90.9	.841	-2.0	.837	-2.1	.405	90.9
9200.0000	.416	89.6	.837	-2.8	.835	-2.9	.415	89.5
9400.0000	.419	87.6	.840	-3.5	.837	-3.5	.419	87.6
9600.0000	.416	86.1	.839	-3.7	.835	-3.7	.416	86.1
9800.0000	.406	84.9	.842	-5.0	.837	-5.0	.405	84.7
10000.0000	.390	86.7	.854	-5.6	.854	-5.6	.388	86.5
10200.0000	.376	89.8	.863	-4.2	.862	-4.3	.374	89.7

10400.0000	.362	89.1	.883	-5.4	.878	-5.5	.360	89.0
10600.0000	.312	90.7	.880	-6.0	.880	-6.1	.310	90.8
10800.0000	.280	93.1	.899	-6.4	.899	-6.4	.280	93.1
11000.0000	.243	94.6	.919	-9.7	.919	-9.8	.242	94.6
11200.0000	.248	92.6	.889	-13.1	.888	-13.2	.248	92.4
11400.0000	.249	89.5	.875	-13.8	.875	-13.9	.249	89.6
11600.0000	.302	85.3	.888	-15.8	.883	-15.8	.302	85.3
11800.0000	.312	84.7	.849	-17.5	.849	-17.5	.311	84.7
12000.0000	.345	93.6	.822	-14.3	.820	-14.4	.345	93.6
12200.0000	.375	95.9	.832	-14.1	.831	-14.2	.375	95.9
12400.0000	.385	91.9	.819	-13.2	.819	-13.2	.385	91.7
12600.0000	.368	86.4	.808	-13.0	.808	-13.0	.367	86.3
12800.0000	.328	79.5	.818	-13.5	.818	-13.5	.326	79.5
13000.0000	.261	76.3	.818	-13.7	.818	-13.7	.259	76.1
13200.0000	.180	93.7	.815	-15.0	.815	-15.0	.180	93.9
13400.0000	.232	123.7	.804	-14.6	.803	-14.7	.232	123.8
13600.0000	.308	129.0	.808	-12.0	.803	-12.1	.308	129.1
13800.0000	.341	125.2	.852	-10.4	.852	-10.4	.340	125.3
14000.0000	.330	117.6	.881	-14.6	.878	-14.6	.330	117.5
14200.0000	.295	109.6	.869	-14.6	.869	-14.7	.295	109.4
14400.0000	.280	98.6	.909	-16.0	.906	-16.1	.280	98.8
14600.0000	.246	82.9	.910	-19.9	.906	-19.9	.245	82.9
14800.0000	.221	77.8	.917	-20.0	.913	-20.1	.221	77.5
15000.0000	.203	76.7	.933	-21.6	.929	-21.6	.203	76.8

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM


COIL # 2., ONR-38
S21-DB LOSS
20.00
16.00
12.00
8.00
4.00
0.00
2000
1300 MHZ/DIV
15000

COIL # 3.,ONR-38

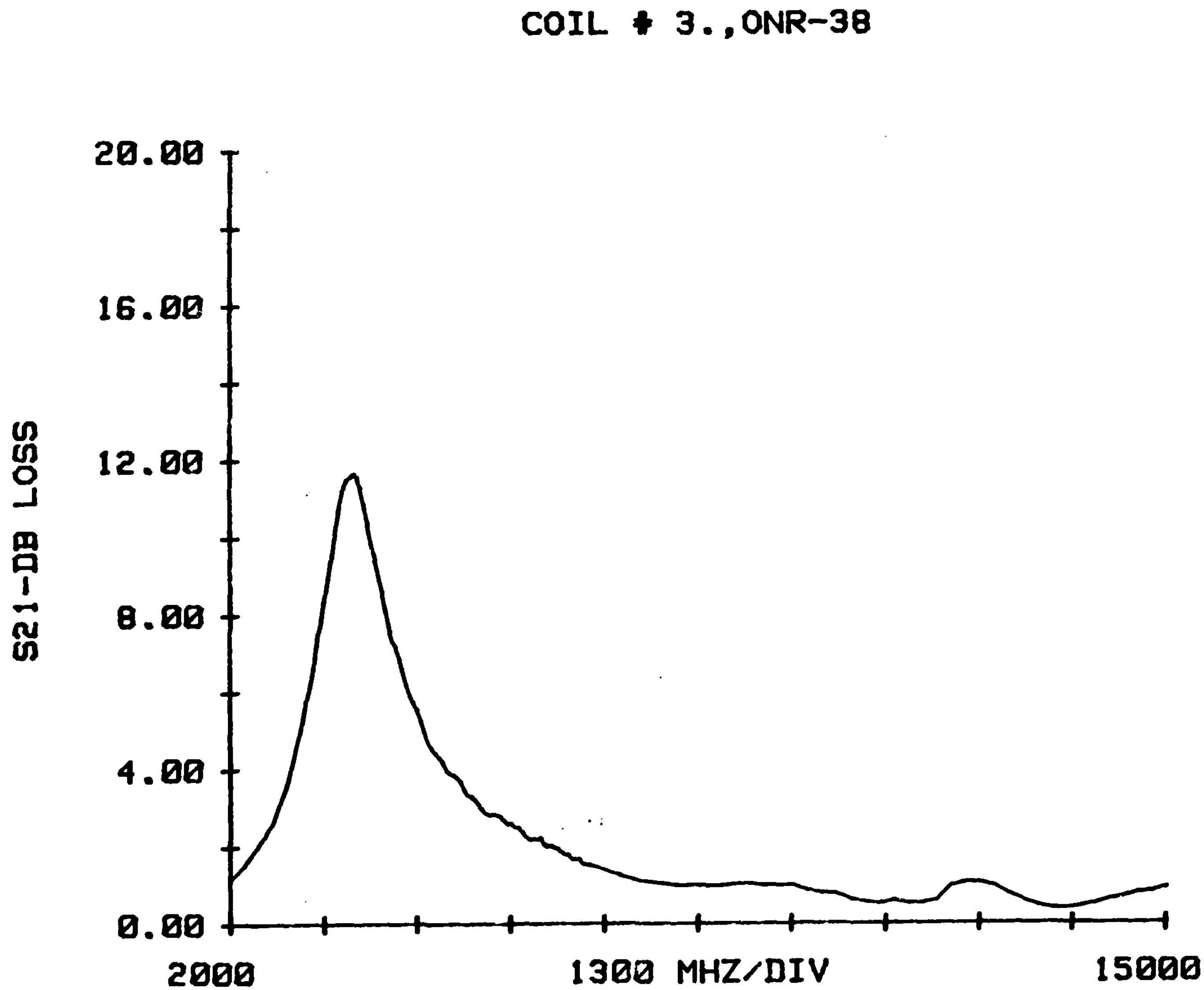
16:39:0 17 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.369	-121.3	.879	-21.2	.879	-21.2	.372	-121.5
2200.0000	.406	-126.6	.840	-24.4	.840	-24.4	.411	-126.9
2400.0000	.451	-132.9	.791	-28.4	.791	-28.3	.456	-133.2
2600.0000	.501	-140.0	.736	-33.0	.737	-33.0	.507	-140.4
2800.0000	.556	-148.0	.653	-36.2	.654	-36.2	.562	-147.9
3000.0000	.611	-155.6	.545	-39.4	.545	-39.4	.615	-155.7
3000.0000	.611	-155.5	.546	-39.5	.546	-39.5	.615	-155.6
3050.0000	.626	-158.6	.516	-39.4	.516	-39.4	.631	-158.7
3100.0000	.637	-159.4	.494	-39.8	.494	-39.8	.642	-159.7
3150.0000	.649	-161.8	.468	-40.4	.468	-40.4	.655	-162.1
3200.0000	.662	-165.3	.431	-40.2	.431	-40.1	.667	-165.4
3200.0000	.662	-165.4	.432	-40.0	.432	-40.1	.667	-165.4
3250.0000	.670	-168.2	.405	-38.8	.405	-38.8	.677	-168.2
3300.0000	.682	-170.5	.381	-36.9	.381	-37.0	.687	-170.6
3350.0000	.689	-173.5	.357	-34.3	.357	-34.3	.693	-173.7
3400.0000	.700	-175.7	.337	-31.9	.337	-32.0	.705	-175.8
3400.0000	.701	-175.8	.337	-31.9	.337	-31.9	.705	-175.9
3450.0000	.705	-177.2	.314	-28.3	.313	-28.3	.710	-177.3
3500.0000	.710	179.8	.291	-23.5	.291	-23.5	.714	179.8
3550.0000	.715	175.8	.276	-18.1	.276	-18.1	.720	175.6
3600.0000	.718	173.8	.267	-12.1	.267	-12.2	.722	173.6
3600.0000	.718	173.8	.267	-12.1	.267	-12.1	.722	173.6
3650.0000	.723	173.1	.266	-6.7	.266	-6.6	.727	173.0
3700.0000	.722	170.3	.263	-1.8	.264	-1.9	.726	170.3
3750.0000	.723	165.8	.265	3.5	.265	3.5	.727	165.8
3800.0000	.728	163.3	.274	7.9	.274	8.0	.730	163.2
3800.0000	.729	163.2	.274	8.0	.274	7.9	.730	163.1
3850.0000	.727	162.9	.288	13.0	.288	13.1	.730	162.7
3900.0000	.725	161.2	.304	16.3	.304	16.2	.726	161.1
3950.0000	.719	157.8	.323	18.9	.323	18.8	.721	157.8
4000.0000	.717	154.6	.336	21.3	.336	21.2	.719	154.5
4000.0000	.716	154.6	.336	21.4	.336	21.3	.718	154.5
4050.0000	.716	154.1	.354	23.5	.354	23.5	.719	154.0
4100.0000	.712	153.6	.372	26.0	.372	26.0	.712	153.5
4150.0000	.710	150.5	.393	27.8	.393	27.8	.710	150.5
4200.0000	.705	147.2	.414	28.1	.414	28.1	.709	147.2
4200.0000	.704	147.0	.414	28.1	.414	28.1	.707	147.0
4250.0000	.702	146.6	.431	28.7	.431	28.7	.703	146.6
4300.0000	.696	145.6	.439	29.7	.440	29.6	.698	145.5
4350.0000	.691	143.8	.455	30.4	.456	30.5	.692	143.7
4400.0000	.687	142.3	.473	30.8	.473	30.9	.689	142.2
4400.0000	.688	142.4	.473	31.0	.474	31.0	.690	142.2
4450.0000	.684	140.7	.493	30.4	.493	30.4	.685	140.6
4500.0000	.678	139.5	.510	29.7	.510	29.6	.679	139.4
4550.0000	.674	138.0	.520	29.0	.519	29.0	.676	137.7
4600.0000	.669	136.8	.530	28.3	.531	28.3	.672	136.8
4600.0000	.669	136.9	.531	28.4	.531	28.3	.671	136.9
4650.0000	.664	135.6	.548	28.5	.548	28.5	.666	135.6
4700.0000	.661	133.5	.569	28.7	.569	28.7	.662	133.5
4750.0000	.658	131.9	.584	27.9	.584	27.9	.659	131.8
4800.0000	.649	132.0	.595	27.2	.595	27.2	.650	131.9
4800.0000	.649	132.0	.595	27.1	.594	27.0	.649	131.9
4850.0000	.646	132.2	.603	27.0	.604	27.0	.646	132.1
4900.0000	.641	129.5	.611	27.0	.611	27.0	.642	129.4
4950.0000	.634	127.1	.619	27.2	.620	27.2	.634	127.0
5000.0000	.630	127.4	.634	26.1	.635	26.1	.632	127.3
5000.0000	.630	127.5	.634	26.2	.634	26.2	.631	127.4

5050.0000	.624	128.0	.642	25.3	.641	25.3	.626	128.0
5100.0000	.622	125.3	.644	24.7	.644	24.7	.622	125.1
5150.0000	.617	122.7	.649	24.5	.650	24.5	.618	122.7
5200.0000	.609	123.0	.657	24.8	.657	24.8	.609	122.9
5200.0000	.609	123.0	.657	24.7	.658	24.7	.609	122.9
5250.0000	.608	124.0	.673	24.2	.673	24.2	.608	123.9
5300.0000	.602	122.2	.684	23.5	.685	23.5	.604	122.2
5350.0000	.596	119.9	.686	23.2	.686	23.2	.597	119.9
5400.0000	.592	119.3	.695	23.2	.695	23.2	.594	119.2
5400.0000	.592	119.3	.694	23.2	.694	23.2	.594	119.2
5450.0000	.590	120.3	.704	23.5	.704	23.6	.590	120.2
5500.0000	.584	119.1	.714	23.7	.715	23.8	.585	119.1
5550.0000	.579	116.8	.723	23.4	.724	23.4	.581	116.8
5600.0000	.574	116.5	.726	23.6	.726	23.6	.574	116.4
5600.0000	.574	116.5	.727	23.6	.727	23.6	.574	116.4
5650.0000	.570	116.7	.725	22.8	.727	22.8	.571	116.6
5700.0000	.564	115.8	.727	22.7	.727	22.7	.566	115.7
5750.0000	.560	114.9	.729	22.8	.729	22.8	.561	114.9
5800.0000	.554	114.8	.738	22.6	.738	22.6	.556	114.7
5800.0000	.554	114.8	.737	22.5	.738	22.5	.555	114.8
5850.0000	.550	113.6	.746	21.7	.747	21.8	.552	113.4
5900.0000	.545	112.9	.745	20.8	.746	20.8	.545	112.7
5950.0000	.542	113.2	.753	20.5	.753	20.5	.542	113.1
6000.0000	.536	112.9	.755	20.8	.756	20.8	.537	112.9
6000.0000	.538	112.8	.756	20.8	.756	20.8	.538	112.8
6050.0000	.529	111.5	.764	20.2	.764	20.2	.529	111.5
6100.0000	.525	110.3	.775	19.7	.775	19.8	.525	110.3
6150.0000	.521	110.7	.782	19.7	.781	19.7	.521	110.6
6200.0000	.516	111.8	.780	19.1	.780	19.1	.516	111.7
6200.0000	.515	111.6	.780	19.2	.780	19.2	.517	111.6
6250.0000	.509	110.2	.781	19.1	.782	19.1	.509	110.1
6300.0000	.502	107.8	.778	18.7	.778	19.7	.502	107.7
6350.0000	.501	108.7	.791	18.6	.791	18.6	.502	108.5
6400.0000	.496	110.0	.799	18.4	.799	18.4	.497	110.0
6400.0000	.496	110.0	.796	18.2	.796	18.2	.496	109.9
6450.0000	.490	108.2	.797	17.5	.797	17.5	.490	108.2
6500.0000	.485	106.0	.802	17.4	.800	17.4	.485	105.9
6550.0000	.482	106.2	.803	17.1	.804	17.1	.482	106.1
6600.0000	.480	107.8	.812	16.8	.811	16.8	.480	107.7
6600.0000	.480	107.8	.812	16.9	.812	16.9	.479	107.7
6650.0000	.473	107.0	.817	16.6	.817	16.6	.473	106.9
6700.0000	.466	104.7	.817	16.0	.817	16.0	.466	104.5
6750.0000	.464	104.2	.828	15.6	.828	15.6	.465	104.1
6800.0000	.458	105.8	.828	15.9	.828	16.0	.458	105.7
6800.0000	.459	105.8	.829	15.8	.829	15.9	.459	105.7
6850.0000	.451	105.8	.829	16.1	.829	16.1	.452	105.7
6900.0000	.448	103.3	.841	16.2	.840	16.2	.448	103.2
6950.0000	.444	102.2	.843	15.7	.843	15.8	.444	102.2
7000.0000	.439	103.4	.844	15.7	.843	15.7	.439	103.4
7000.0000	.439	103.5	.844	15.6	.844	15.6	.439	103.4
7200.0000	.421	101.3	.855	15.8	.854	15.8	.421	101.2
7400.0000	.408	99.4	.870	14.7	.871	14.7	.408	99.4
7600.0000	.393	98.4	.881	13.4	.881	13.4	.393	98.3
7800.0000	.382	97.4	.886	11.5	.886	11.5	.382	97.4
8000.0000	.376	97.2	.892	9.7	.893	9.7	.376	97.1
8200.0000	.373	96.0	.896	8.4	.894	8.4	.372	96.0
8400.0000	.371	94.7	.894	7.8	.894	7.9	.371	94.7
8600.0000	.369	93.6	.897	7.8	.897	7.8	.369	93.5
8800.0000	.368	92.8	.897	7.0	.897	7.1	.368	92.8
9000.0000	.367	92.2	.893	6.8	.893	6.9	.366	92.1
9200.0000	.362	91.5	.891	5.3	.891	5.4	.362	91.3
9400.0000	.355	91.1	.897	4.6	.897	4.6	.355	90.9
9600.0000	.346	90.9	.897	4.1	.898	4.2	.345	90.8
9800.0000	.336	91.1	.896	3.6	.897	3.7	.336	91.1
10000.0000	.324	91.0	.910	3.1	.909	3.2	.324	90.9
10200.0000	.311	90.8	.918	4.1	.917	4.1	.311	90.7

10400.0000	.297	90.7	.920	3.9	.921	4.0	.297	90.6
10600.0000	.279	91.4	.934	3.3	.934	3.4	.279	91.2
10800.0000	.267	92.0	.942	1.2	.943	1.3	.267	91.9
11000.0000	.267	93.4	.948	-.1	.948	.0	.267	93.2
11200.0000	.282	94.3	.938	-2.0	.938	-2.0	.282	94.1
11400.0000	.290	97.5	.947	-2.7	.946	-2.7	.289	97.3
11600.0000	.286	103.2	.945	-2.8	.944	-2.7	.286	103.0
11800.0000	.317	103.4	.938	-3.6	.938	-3.5	.317	103.4
12000.0000	.379	96.1	.897	-3.8	.895	-3.8	.379	96.0
12200.0000	.398	92.7	.889	-3.1	.888	-3.0	.398	92.7
12400.0000	.373	93.1	.891	-2.0	.890	-2.0	.373	93.1
12600.0000	.327	93.6	.898	-2.9	.898	-2.8	.326	93.6
12800.0000	.268	93.0	.920	-3.4	.920	-3.3	.268	92.9
13000.0000	.207	92.7	.937	-3.9	.937	-3.8	.206	92.6
13200.0000	.161	94.9	.953	-5.1	.952	-5.1	.160	94.6
13400.0000	.191	99.2	.962	-6.6	.962	-6.5	.191	98.9
13600.0000	.204	97.2	.961	-7.2	.961	-7.1	.203	97.1
13800.0000	.231	92.5	.956	-8.4	.956	-8.4	.231	92.3
14000.0000	.255	86.4	.948	-9.6	.947	-9.6	.255	86.3
14200.0000	.282	81.5	.937	-10.8	.937	-10.7	.282	81.6
14400.0000	.306	78.6	.930	-12.2	.930	-12.1	.306	78.5
14600.0000	.328	76.8	.918	-13.0	.918	-12.9	.328	76.5
14800.0000	.349	75.6	.915	-12.9	.914	-12.8	.349	75.5
15000.0000	.362	75.1	.904	-12.8	.904	-12.7	.362	74.9

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM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S21-DB LOSS
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16.00
12.00
8.00
4.00
0.00
2000
1300 MHZ/DIV
15000

COIL # 4 ONR-38

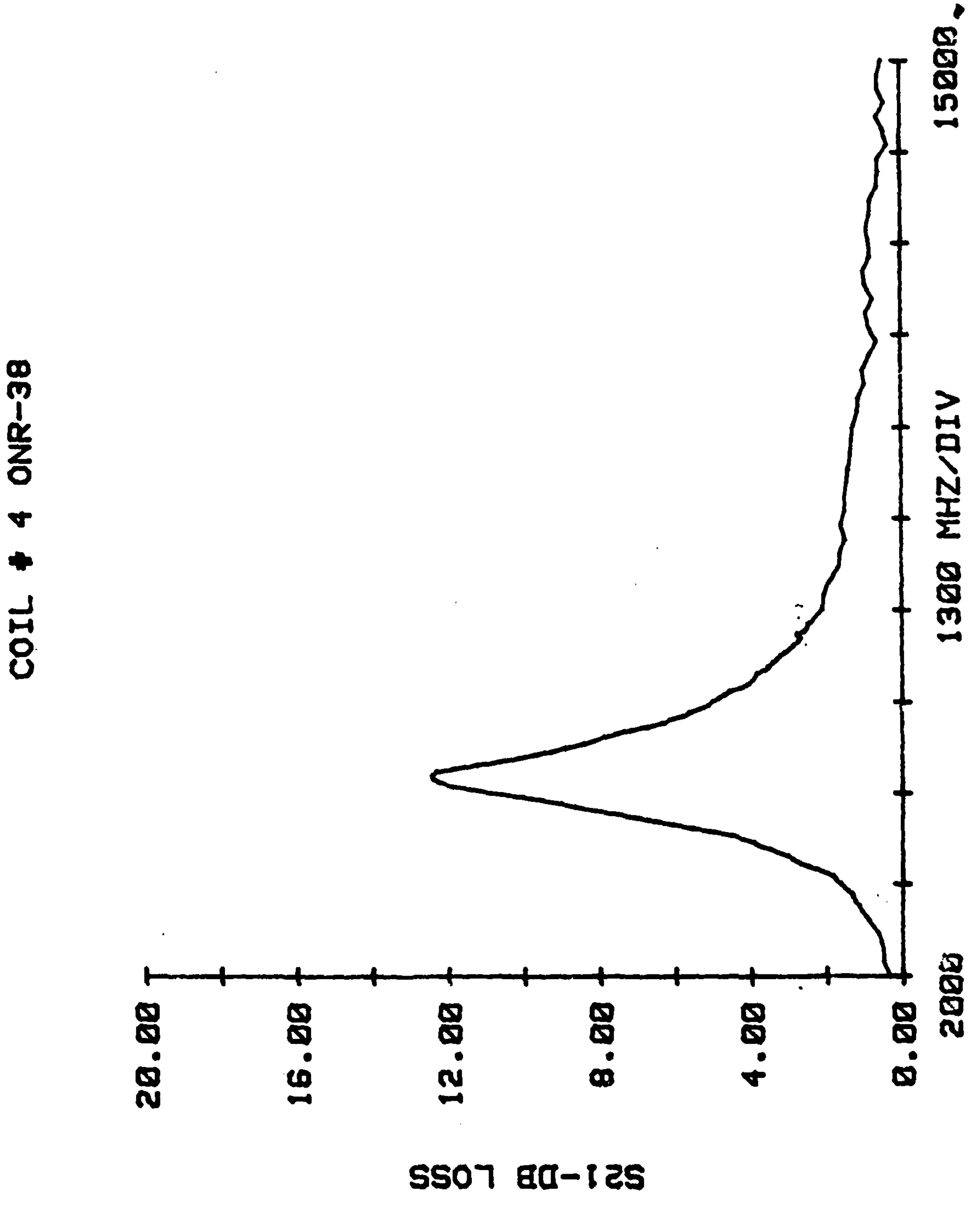
17:0:20 17 OCT 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.0000	.229	-109.1	.965	-14.8	.963	-15.1	.233	-105.7
2200.0000	.250	-108.8	.948	-15.6	.946	-15.8	.253	-105.7
2400.0000	.273	-112.8	.946	-16.9	.945	-17.1	.274	-109.5
2600.0000	.287	-118.0	.933	-19.8	.933	-20.1	.286	-114.8
2800.0000	.303	-123.6	.904	-21.7	.904	-22.0	.302	-119.9
3000.0000	.338	-127.3	.877	-24.8	.877	-25.2	.336	-123.6
3000.0000	.338	-127.2	.879	-24.8	.879	-25.2	.336	-123.5
3050.0000	.349	-128.4	.868	-25.5	.869	-26.1	.347	-124.8
3100.0000	.360	-127.7	.864	-26.5	.864	-27.0	.357	-123.9
3150.0000	.371	-129.5	.862	-27.7	.862	-28.1	.369	-125.6
3200.0000	.383	-132.7	.849	-28.9	.847	-29.4	.382	-128.8
3200.0000	.383	-132.7	.850	-28.9	.847	-29.4	.382	-128.7
3250.0000	.394	-133.8	.841	-29.6	.838	-30.1	.393	-129.6
3300.0000	.410	-133.2	.833	-30.0	.834	-30.6	.409	-129.1
3350.0000	.421	-134.8	.820	-30.4	.820	-31.0	.421	-130.8
3400.0000	.434	-137.4	.813	-31.2	.814	-31.7	.434	-133.6
3400.0000	.434	-137.4	.813	-31.1	.814	-31.6	.434	-133.6
3450.0000	.446	-140.3	.797	-32.1	.797	-32.8	.446	-136.3
3500.0000	.457	-141.0	.776	-33.2	.773	-33.9	.458	-136.8
3550.0000	.470	-141.9	.754	-34.1	.752	-34.8	.472	-137.6
3600.0000	.483	-144.4	.734	-34.6	.734	-35.3	.485	-140.3
3600.0000	.483	-144.3	.734	-34.5	.734	-35.2	.485	-140.3
3650.0000	.495	-147.2	.719	-35.1	.719	-35.9	.497	-143.0
3700.0000	.511	-148.4	.709	-36.0	.710	-36.7	.514	-143.9
3750.0000	.524	-149.6	.687	-37.1	.684	-37.6	.527	-145.2
3800.0000	.539	-150.9	.671	-37.1	.667	-37.7	.541	-146.8
3800.0000	.541	-151.0	.672	-37.0	.668	-37.6	.542	-146.8
3850.0000	.558	-153.5	.649	-37.2	.647	-37.8	.560	-149.4
3900.0000	.574	-156.6	.638	-37.4	.638	-37.9	.575	-152.2
3950.0000	.587	-158.5	.617	-38.3	.616	-38.8	.589	-153.8
4000.0000	.599	-159.8	.596	-40.1	.593	-40.6	.599	-155.3
4000.0000	.598	-160.0	.596	-40.1	.594	-40.7	.601	-155.5
4050.0000	.611	-161.9	.562	-40.6	.559	-41.0	.613	-157.6
4100.0000	.617	-165.9	.530	-42.0	.528	-42.5	.619	-161.5
4150.0000	.629	-169.7	.500	-42.2	.497	-42.8	.631	-165.2
4200.0000	.635	-170.2	.473	-42.3	.470	-42.9	.638	-165.8
4200.0000	.635	-170.3	.473	-42.2	.470	-42.8	.637	-165.9
4250.0000	.651	-172.5	.448	-42.6	.446	-43.1	.654	-168.1
4300.0000	.672	-174.8	.419	-42.7	.419	-43.1	.673	-170.4
4350.0000	.688	-177.3	.395	-40.9	.393	-41.5	.689	-172.7
4400.0000	.713	-177.9	.371	-39.1	.369	-39.4	.712	-173.2
4400.0000	.713	-177.9	.371	-39.0	.369	-39.4	.713	-173.3
4450.0000	.734	-177.8	.355	-36.2	.354	-36.6	.733	-173.0
4500.0000	.747	-178.7	.334	-34.7	.334	-35.1	.746	-173.9
4550.0000	.762	178.0	.314	-32.5	.312	-32.9	.760	-177.2
4600.0000	.759	176.0	.286	-29.4	.285	-29.7	.755	-179.3
4600.0000	.757	176.1	.286	-29.4	.286	-29.5	.755	-179.2
4650.0000	.760	173.5	.271	-25.1	.271	-25.4	.760	178.3
4700.0000	.753	169.7	.254	-20.4	.254	-20.8	.754	174.5
4750.0000	.747	167.3	.246	-15.6	.246	-16.2	.748	172.0
4800.0000	.742	166.4	.241	-9.4	.242	-10.0	.742	171.0
4800.0000	.742	166.5	.241	-9.6	.241	-10.0	.743	171.1
4850.0000	.744	164.8	.240	-3.8	.240	-4.3	.745	169.6
4900.0000	.743	163.3	.243	2.4	.243	2.0	.743	168.3
4950.0000	.762	163.8	.258	9.3	.258	8.9	.761	169.0
5000.0000	.767	163.7	.275	14.1	.275	13.5	.767	168.7
5000.0000	.768	163.8	.275	14.2	.275	13.6	.768	168.8

5050.0000	.778	161.6	.296	17.5	.296	17.0	.776	166.6
5100.0000	.778	157.4	.313	20.1	.312	19.5	.779	162.9
5150.0000	.774	155.9	.328	21.7	.330	21.4	.773	161.6
5200.0000	.765	155.9	.347	24.4	.349	23.9	.765	161.5
5200.0000	.765	155.9	.347	24.4	.349	23.9	.764	161.5
5250.0000	.744	153.5	.362	24.8	.364	24.2	.744	158.8
5300.0000	.725	149.1	.381	24.8	.383	24.0	.725	154.6
5350.0000	.710	148.0	.394	25.5	.396	24.7	.710	153.8
5400.0000	.698	149.0	.406	25.7	.409	24.9	.698	154.6
5400.0000	.698	149.0	.406	25.7	.408	24.8	.699	154.6
5450.0000	.689	147.7	.422	26.9	.423	25.9	.690	152.8
5500.0000	.679	143.3	.439	28.3	.441	27.2	.680	148.4
5550.0000	.681	141.0	.463	28.6	.464	27.6	.680	146.6
5600.0000	.690	142.3	.486	29.6	.486	28.6	.688	148.0
5600.0000	.689	142.3	.486	29.5	.486	28.5	.687	148.0
5650.0000	.685	141.5	.495	29.0	.494	28.0	.685	146.9
5700.0000	.687	138.3	.516	29.5	.515	28.5	.687	143.9
5750.0000	.685	136.2	.525	29.7	.524	28.8	.683	141.9
5800.0000	.676	136.9	.543	29.7	.542	28.6	.676	142.8
5800.0000	.677	137.0	.543	29.7	.541	28.5	.676	142.8
5850.0000	.670	136.0	.557	28.5	.556	27.4	.671	141.5
5900.0000	.655	133.2	.562	27.5	.560	26.4	.656	138.4
5950.0000	.652	131.1	.573	27.2	.571	26.0	.651	136.4
6000.0000	.644	131.3	.585	27.8	.583	26.6	.646	136.6
6000.0000	.645	131.1	.585	27.7	.583	26.5	.647	136.5
6050.0000	.636	130.1	.593	27.3	.591	26.2	.638	135.3
6100.0000	.632	128.4	.615	27.3	.613	26.0	.634	133.6
6150.0000	.631	128.0	.627	27.4	.623	26.2	.634	133.2
6200.0000	.627	129.0	.636	26.6	.630	25.5	.629	134.1
6200.0000	.627	128.9	.636	26.7	.630	25.6	.629	134.1
6250.0000	.620	127.4	.641	26.5	.637	25.5	.623	132.3
6300.0000	.613	125.4	.645	26.0	.640	25.0	.615	130.3
6350.0000	.610	126.2	.660	25.7	.655	24.7	.615	131.1
6400.0000	.602	126.8	.671	25.4	.665	24.4	.608	131.4
6400.0000	.602	126.8	.668	25.2	.663	24.2	.607	131.3
6450.0000	.596	124.3	.677	24.1	.671	23.1	.601	128.8
6500.0000	.591	122.6	.685	24.1	.677	23.3	.596	127.2
6550.0000	.588	123.9	.693	23.6	.685	22.8	.593	128.4
6600.0000	.587	125.1	.704	23.6	.698	22.8	.591	129.4
6600.0000	.586	125.1	.704	23.6	.698	22.9	.590	129.4
6650.0000	.579	122.4	.714	22.9	.709	22.2	.584	126.3
6700.0000	.568	119.1	.721	22.2	.716	21.5	.572	123.4
6750.0000	.571	121.4	.731	21.7	.725	21.1	.575	125.6
6800.0000	.554	122.9	.737	21.4	.731	20.8	.558	126.8
6800.0000	.555	122.9	.738	21.4	.731	20.8	.559	126.8
6850.0000	.551	119.9	.729	21.1	.723	20.5	.554	123.5
6900.0000	.540	117.7	.748	21.1	.743	20.5	.544	121.4
6950.0000	.538	118.0	.753	20.4	.745	19.8	.540	121.9
7000.0000	.531	120.3	.756	19.5	.752	18.9	.532	124.1
7000.0000	.531	120.3	.756	19.4	.752	18.9	.533	124.0
7200.0000	.516	119.2	.789	19.0	.788	18.5	.515	123.0
7400.0000	.506	119.5	.793	18.8	.793	18.3	.502	123.3
7600.0000	.489	113.7	.806	17.1	.809	16.5	.481	118.2
7800.0000	.476	112.6	.830	15.1	.835	14.3	.468	118.2
8000.0000	.444	109.9	.834	15.0	.840	13.9	.434	116.8
8200.0000	.417	107.9	.846	10.5	.854	9.3	.413	116.4
8400.0000	.419	104.7	.836	9.4	.839	7.7	.416	114.4
8600.0000	.420	103.7	.847	9.8	.847	8.1	.421	114.4
8800.0000	.423	98.7	.846	9.1	.844	7.3	.429	110.2
9000.0000	.418	97.5	.850	9.2	.847	7.4	.430	109.6
9200.0000	.418	96.6	.855	8.4	.844	6.5	.435	108.9
9400.0000	.414	95.2	.861	7.7	.851	6.1	.434	107.3
9600.0000	.408	93.9	.864	7.5	.853	6.1	.428	105.7
9800.0000	.396	93.3	.868	6.0	.859	4.6	.414	104.5
10000.0000	.383	94.9	.880	5.2	.874	3.8	.396	106.1
10200.0000	.374	98.2	.883	6.3	.875	5.0	.382	109.4

10400.0000	.373	97.0	.899	5.3	.899	4.4	.373	109.2
10600.0000	.328	96.8	.894	5.2	.898	3.9	.323	111.4
10800.0000	.304	95.9	.914	5.9	.914	4.3	.288	114.3
11000.0000	.259	90.7	.934	3.3	.943	1.8	.244	115.9
11200.0000	.254	85.3	.910	.6	.921	-1.4	.239	113.2
11400.0000	.244	78.2	.903	.8	.909	-2.2	.222	107.7
11600.0000	.269	74.4	.923	-1.5	.925	-3.7	.255	103.6
11800.0000	.267	72.4	.901	-2.2	.911	-5.7	.264	99.7
12000.0000	.276	82.6	.897	.2	.885	-3.6	.295	107.2
12200.0000	.290	87.2	.916	.1	.899	-3.4	.325	108.6
12400.0000	.300	87.8	.912	.3	.889	-2.9	.340	106.8
12600.0000	.299	85.8	.904	-.2	.883	-3.1	.334	103.4
12800.0000	.294	84.1	.914	-.8	.896	-3.6	.322	100.2
13000.0000	.291	84.7	.914	-.8	.900	-3.6	.310	99.2
13200.0000	.292	87.1	.934	-2.3	.923	-5.0	.297	99.7
13400.0000	.280	88.1	.938	-4.3	.936	-7.3	.269	100.7
13600.0000	.256	94.7	.939	-3.5	.938	-7.1	.227	109.7
13800.0000	.236	101.8	.966	-4.0	.960	-7.9	.204	123.7
14000.0000	.229	103.6	.955	-7.2	.957	-11.5	.203	129.9
14200.0000	.229	100.0	.935	-7.0	.935	-12.8	.199	127.1
14400.0000	.249	89.5	.957	-8.1	.945	-14.1	.205	115.6
14600.0000	.247	75.3	.938	-11.2	.933	-17.7	.211	99.8
14800.0000	.246	70.7	.939	-10.4	.920	-18.3	.234	93.4
15000.0000	.241	69.7	.949	-11.5	.917	-19.7	.274	88.5

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM


COIL # 4 ONR-38
S21-DB LOSS
20.00
16.00
12.00
8.00
4.00
0.00
2000
1300 MHZ/DIV
15000.

COIL,ONR-38,#5

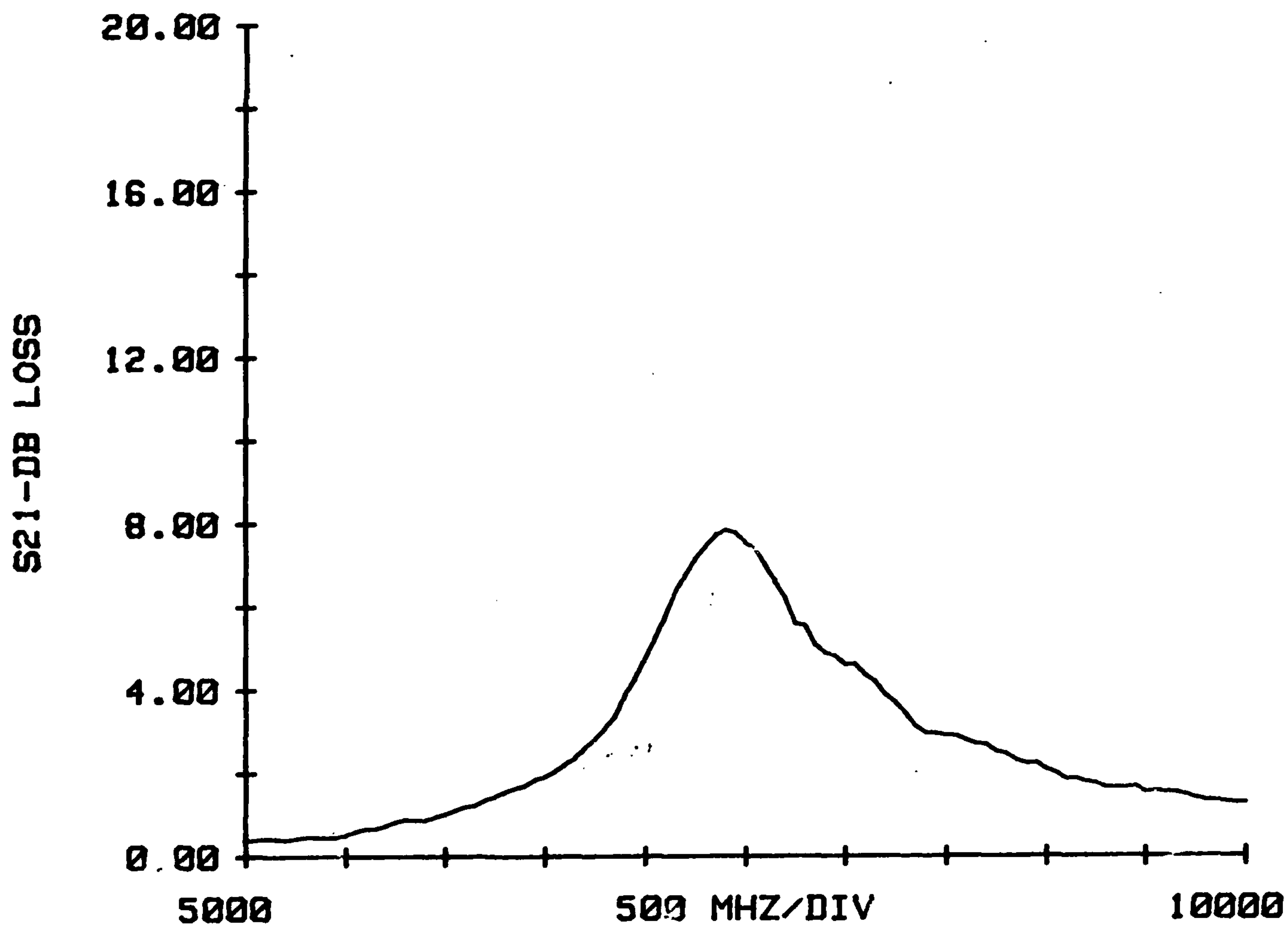
10:41:59 4 NOV 80

FREQUENCY	REFL COEFF -IN S11		LOSS-FORWARD S21		LOSS-REVERSE S12		REFL COEFF -OUT S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
5000.0000	.073	-109.1	.958	-15.9	.958	-16.0	.073	-109.1
5050.0000	.068	-123.6	.957	-15.6	.952	-15.7	.067	-123.8
5100.0000	.062	-154.2	.953	-15.2	.953	-15.3	.062	-154.3
5150.0000	.079	-166.8	.954	-14.9	.952	-15.0	.079	-167.0
5200.0000	.083	-176.9	.957	-15.3	.957	-15.3	.083	-177.2
5250.0000	.096	176.1	.953	-16.2	.953	-16.2	.096	175.9
5300.0000	.098	176.3	.950	-17.2	.950	-17.2	.098	176.3
5350.0000	.094	176.5	.949	-18.5	.949	-18.5	.094	176.3
5400.0000	.091	-177.9	.951	-19.6	.951	-19.6	.090	-178.2
5450.0000	.086	-162.5	.951	-20.4	.951	-20.5	.085	-162.9
5500.0000	.081	-148.8	.943	-20.9	.943	-21.0	.081	-148.9
5550.0000	.092	-139.5	.934	-20.9	.934	-21.0	.091	-139.4
5600.0000	.105	-126.0	.928	-20.9	.928	-20.9	.105	-125.9
5650.0000	.1[illegible]2	-120.1	.928	-21.0	.928	-21.0	.111	-120.0
5700.0000	.131	-116.4	.921	-21.0	.921	-21.0	.130	-116.5
5750.0000	.141	-113.8	.911	-21.2	.911	-21.2	.141	-113.7
5800.0000	.156	-117.1	.904	-21.6	.905	-21.6	.156	-117.1
5850.0000	.168	-119.5	.907	-22.3	.907	-22.3	.168	-119.4
5900.0000	.182	-123.6	.906	-23.6	.906	-23.6	.181	-123.4
5950.0000	.193	-125.3	.898	-24.9	.898	-24.9	.193	-125.2
6000.0000	.206	-128.4	.891	-25.9	.891	-25.9	.205	-128.2
6050.0000	.2[illegible]8	-128.8	.881	-26.4	.881	-26.5	.217	-128.8
6100.0000	.224	-130.7	.873	-26.4	.873	-26.4	.223	-130.7
6150.0000	.238	-131.1	.870	-26.5	.872	-26.6	.237	-131.2
6200.0000	.244	-131.2	.857	-26.8	.857	-26.9	.244	-131.2
6250.0000	.256	-131.7	.851	-27.1	.851	-27.1	.256	-131.6
6300.0000	.267	-132.3	.839	-27.4	.839	-27.4	.267	-132.2
6350.0000	.276	-133.1	.831	-28.5	.831	-28.6	.275	-133.0
6400.0000	.285	-134.1	.824	-29.1	.824	-29.2	.285	-134.1
6450.0000	.295	-135.1	.810	-29.3	.810	-29.4	.295	-135.0
6500.0000	.304	-137.3	.804	-29.3	.804	-29.3	.303	-137.2
6550.0000	.3[illegible]6	-140.9	.792	-29.8	.792	-29.8	.314	-140.8
6600.0000	.324	-145.0	.777	-30.6	.777	-30.8	.322	-144.9
6650.0000	.338	-147.3	.763	-32.1	.763	-32.1	.338	-147.3
6700.0000	.343	-149.0	.742	-33.2	.743	-33.3	.343	-148.9
6750.0000	.360	-151.3	.724	-34.5	.727	-34.7	.360	-151.3
6800.0000	.377	-151.0	.702	-36.1	.702	-36.2	.375	-151.2
6850.0000	.394	-153.3	.679	-37.5	.679	-37.5	.394	-153.3
6900.0000	.4[illegible]8	-155.3	.641	-38.1	.641	-38.3	.417	-155.1
6950.0000	.438	-157.4	.613	-38.1	.613	-38.0	.436	-157.3
7000.0000	.462	-159.0	.580	-36.9	.579	-37.1	.460	-158.9
7050.0000	.484	-159.4	.548	-35.8	.548	-35.8	.484	-159.4
7100.0000	.507	-159.1	.515	-33.5	.515	-33.7	.505	-158.9
7150.0000	.522	-160.4	.482	-31.1	.483	-31.3	.522	-160.4
7200.0000	.542	-161.6	.459	-27.2	.461	-27.2	.539	-161.4
7250.0000	.553	-163.6	.439	-24.9	.439	-24.9	.550	-163.4
7300.0000	.557	-165.1	.424	-21.4	.424	-21.4	.557	-165.0
7350.0000	.574	-165.2	.412	-17.2	.412	-17.4	.573	-165.0
7400.0000	.572	-166.0	.406	-14.2	.406	-14.2	.571	-165.7
7450.0000	.572	-166.5	.409	-[illegible].6	.409	-9.8	.572	-166.5
7500.0000	.571	-170.2	.421	-7.9	.421	-7.8	.570	-170.2
7550.0000	.550	-173.3	.428	-4.6	.428	-4.7	.550	-173.2
7600.0000	.539	-176.0	.449	-1.1	.449	-1.2	.539	-176.0
7650.0000	.520	-179.4	.469	1.1	.468	1.0	.520	-179.4
7700.0000	.501	177.9	.491	2.9	.491	2.8	.501	177.9
7750.0000	.496	172.8	.526	3.5	.526	3.4	.496	172.8
7800.0000	.470	166.9	.529	4.6	.529	4.5	.470	166.9

7850.0000	.480	160.5	.558	4.4	.558	4.2	.480	160.6
7900.0000	.471	152.6	.571	5.1	.571	5.0	.471	152.8
7950.0000	.480	146.8	.575	4.7	.575	4.6	.480	146.9
8000.0000	.488	141.2	.590	4.8	.588	4.7	.487	141.4
8050.0000	.495	135.8	.588	5.6	.588	5.6	.494	135.8
8100.0000	.510	133.2	.606	7.6	.606	7.5	.510	133.3
8150.0000	.519	130.3	.618	8.0	.618	8.0	.518	130.3
8200.0000	.525	131.8	.641	9.9	.640	9.8	.522	132.1
8250.0000	.536	131.4	.656	10.1	.656	10.1	.536	131.4
8300.0000	.525	132.0	.675	9.7	.675	9.5	.525	132.1
8350.0000	.525	130.0	.700	9.1	.696	9.0	.525	130.0
8400.0000	.526	130.8	.713	6.3	.713	6.1	.526	130.7
8450.0000	.504	132.2	.714	5.7	.711	5.6	.504	132.2
8500.0000	.510	132.7	.717	4.5	.717	4.3	.510	132.7
8550.0000	.489	133.2	.719	4.3	.719	4.3	.489	133.1
8600.0000	.485	130.4	.727	4.6	.727	4.5	.485	130.4
8650.0000	.474	128.2	.735	4.2	.735	4.1	.474	128.1
8700.0000	.469	125.4	.736	5.1	.736	5.1	.469	125.4
8750.0000	.464	126.1	.750	5.5	.750	5.3	.465	126.1
8800.0000	.451	125.1	.755	5.6	.755	5.5	.451	125.0
8850.0000	.448	124.1	.769	4.9	.769	4.8	.448	124.0
8900.0000	.430	121.5	.776	4.5	.776	4.5	.430	121.5
8950.0000	.429	119.3	.774	4.2	.773	4.1	.429	119.3
9000.0000	.413	118.4	.788	3.6	.788	3.2	.413	118.4
9050.0000	.409	117.7	.797	2.9	.794	2.8	.408	117.7
9100.0000	.399	118.2	.810	2.6	.810	2.4	.399	118.1
9150.0000	.387	116.7	.809	2.3	.809	2.2	.386	116.6
9200.0000	.379	115.4	.816	2.7	.815	2.6	.379	115.4
9250.0000	.373	114.1	.819	2.8	.819	2.7	.373	114.2
9300.0000	.367	114.1	.829	2.4	.829	2.3	.367	114.1
9350.0000	.361	114.1	.829	2.1	.829	1.9	.361	114.1
9400.0000	.359	113.3	.830	1.6	.830	1.4	.359	113.3
9450.0000	.356	112.6	.827	1.0	.827	.9	.356	112.5
9500.0000	.355	111.5	.839	.7	.839	.5	.355	111.5
9550.0000	.354	110.7	.837	.2	.837	.1	.354	110.7
9600.0000	.352	109.8	.840	.2	.840	.1	.352	109.7
9650.0000	.348	107.9	.841	.0	.837	-.0	.348	107.8
9700.0000	.344	105.3	.846	.3	.846	.2	.344	105.2
9750.0000	.342	103.3	.854	-.1	.854	-.3	.342	103.2
9800.0000	.337	103.2	.859	-.5	.860	-.7	.337	103.1
9850.0000	.334	103.6	.860	-.9	.860	-1.0	.334	103.5
9900.0000	.335	104.8	.862	-1.6	.862	-1.8	.335	104.9
9950.0000	.332	104.8	.866	-2.2	.866	-2.3	.331	104.8
10000.0000	.340	104.3	.865	-2.7	.865	-2.9	.339	104.3

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM

COIL,ONR-38,#5



COIL,ONR-38,#7

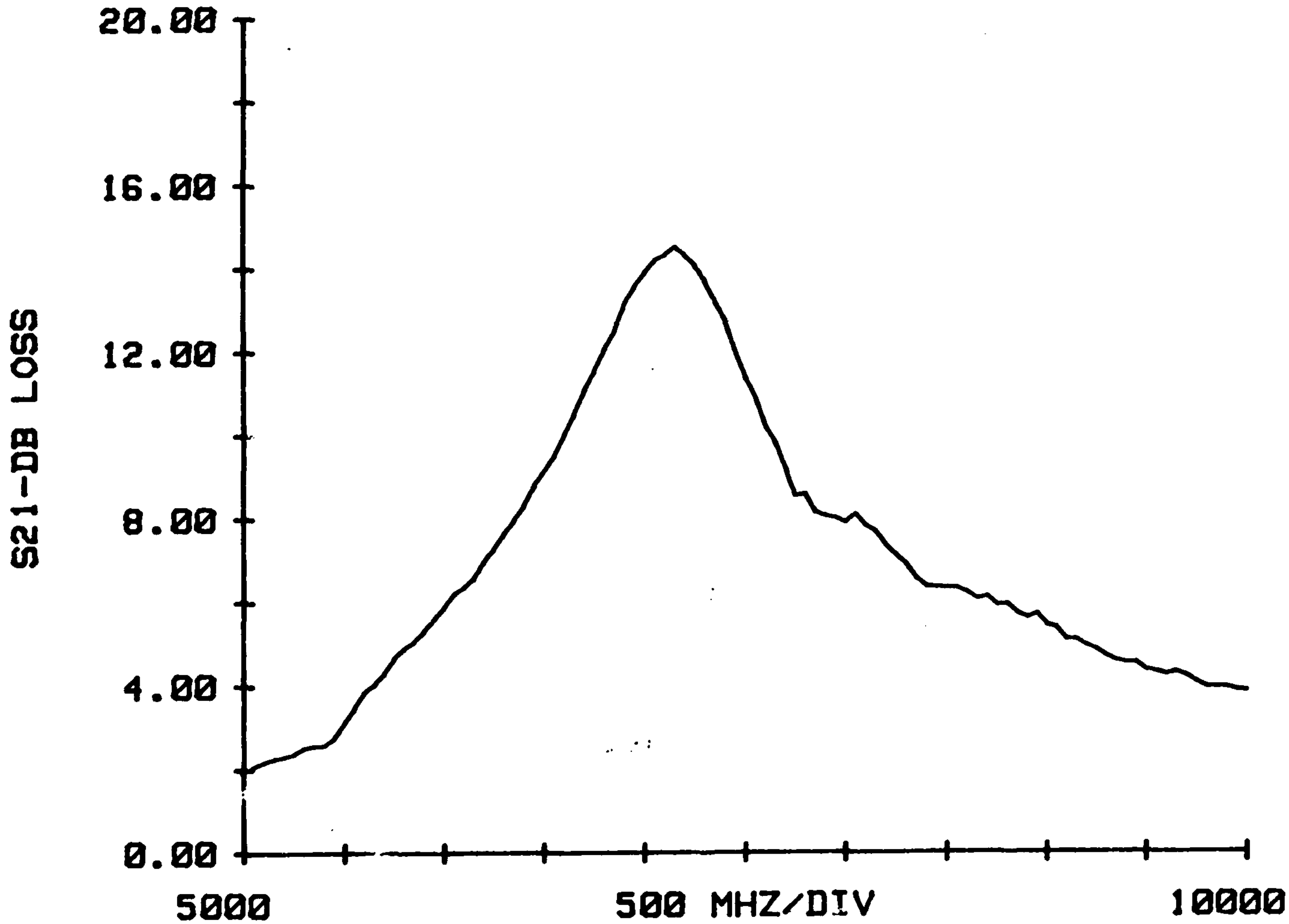
12:2:50 4 NOV 80

FREQUENCY	REFL COEFF -IN		LOSS-FORWARD		LOSS-REVERSE		REFL COEFF -OUT	
	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
5000.0000	.406	-151.3	.804	-36.6	.804	-36.6	.408	-151.4
5050.0000	.413	-156.0	.788	-37.1	.788	-37.1	.414	-156.1
5100.0000	.411	-160.2	.780	-37.6	.778	-37.7	.414	-160.4
5150.0000	.428	-162.1	.773	-38.1	.773	-38.1	.428	-162.4
5200.0000	.433	-162.5	.768	-39.8	.768	-39.9	.436	-162.6
5250.0000	.448	-163.4	.762	-41.5	.762	-41.4	.448	-163.4
5300.0000	.470	-164.3	.749	-42.8	.749	-42.8	.472	-164.1
5350.0000	.489	-165.1	.746	-44.6	.746	-44.5	.492	-165.0
5400.0000	.508	-165.3	.745	-45.9	.744	-45.9	.511	-165.3
5450.0000	.528	-163.4	.729	-47.5	.729	-47.4	.528	-163.5
5500.0000	.538	-162.0	.700	-48.7	.700	-48.7	.538	-162.1
5550.0000	.545	-162.1	.673	-48.3	.673	-48.2	.548	-162.1
5600.0000	.555	-162.3	.643	-48.1	.643	-48.1	.555	-162.4
5650.0000	.560	-163.6	.630	-48.6	.630	-48.6	.560	-163.7
5700.0000	.574	-164.0	.611	-48.5	.611	-48.4	.574	-164.1
5750.0000	.586	-164.4	.587	-49.2	.587	-49.3	.586	-164.5
5800.0000	.598	-165.2	.570	-49.7	.570	-49.5	.598	-165.3
5850.0000	.612	-166.8	.560	-50.9	.559	-50.9	.616	-166.9
5900.0000	.622	-170.0	.544	-52.8	.543	-52.7	.622	-170.1
5950.0000	.631	-173.1	.526	-53.5	.526	-53.5	.632	-173.0
6000.0000	.643	-174.7	.509	-53.1	.509	-53.1	.643	-174.7
6050.0000	.652	-174.9	.490	-52.8	.490	-52.8	.652	-174.9
6100.0000	.663	-175.1	.482	-52.4	.482	-52.3	.663	-175.2
6150.0000	.677	-176.1	.470	-52.3	.470	-52.2	.677	-176.3
6200.0000	.684	-177.3	.449	-52.5	.449	-52.4	.686	-177.4
6250.0000	.691	-178.6	.434	-52.2	.434	-52.1	.691	-178.8
6300.0000	.698	179.9	.416	-51.8	.416	-51.8	.698	179.9
6350.0000	.700	178.6	.401	-51.9	.401	-52.0	.700	178.4
6400.0000	.707	176.9	.385	-51.4	.385	-51.4	.707	176.8
6450.0000	.715	174.6	.365	-50.5	.365	-50.3	.715	174.5
6500.0000	.721	172.7	.350	-49.3	.350	-49.3	.721	172.6
6550.0000	.728	171.5	.335	-48.2	.335	-48.2	.730	171.5
6600.0000	.732	170.0	.316	-48.0	.317	-47.8	.732	170.1
6650.0000	.741	167.5	.299	-47.6	.299	-47.5	.741	167.5
6700.0000	.745	165.1	.280	-45.9	.281	-45.9	.745	165.1
6750.0000	.749	163.5	.265	-44.4	.265	-44.3	.749	163.5
6800.0000	.756	163.2	.250	-42.9	.250	-42.7	.759	163.2
6850.0000	.773	162.7	.238	-41.2	.238	-41.2	.773	162.6
6900.0000	.774	162.6	.221	-37.4	.221	-37.2	.774	162.5
6950.0000	.784	161.5	.211	-32.7	.211	-32.6	.784	161.5
7000.0000	.785	159.4	.203	-27.2	.203	-27.1	.786	159.4
7050.0000	.785	158.0	.196	-21.7	.196	-21.7	.786	157.9
7100.0000	.786	159.1	.193	-15.3	.193	-15.3	.789	158.9
7150.0000	.782	161.4	.189	-8.6	.189	-8.5	.782	161.3
7200.0000	.789	163.2	.193	-1.1	.193	-1.0	.790	163.0
7250.0000	.790	162.3	.199	3.9	.199	4.0	.790	162.2
7300.0000	.778	161.8	.208	9.7	.208	9.7	.778	161.8
7350.0000	.788	160.5	.220	14.4	.220	14.5	.789	160.5
7400.0000	.770	161.0	.231	17.4	.231	17.5	.772	161.0
7450.0000	.766	161.6	.252	21.3	.252	21.3	.766	161.5
7500.0000	.753	158.1	.271	20.6	.271	20.7	.753	158.1
7550.0000	.717	155.7	.286	21.5	.286	21.6	.717	155.8
7600.0000	.709	152.3	.309	21.9	.309	21.9	.709	152.2
7650.0000	.678	148.5	.325	21.6	.325	21.6	.678	148.4
7700.0000	.676	148.1	.348	21.6	.348	21.6	.676	148.1
7750.0000	.678	143.5	.375	19.4	.375	19.4	.678	143.4
7800.0000	.667	140.5	.373	18.8	.373	18.9	.667	140.4

7850.0000	.689	136.4	.392	16.7	.392	16.7	.691	136.3
7900.0000	.687	132.0	.396	16.7	.396	16.8	.687	132.0
7950.0000	.704	130.3	.398	16.5	.399	16.5	.704	130.4
8000.0000	.716	127.2	.403	15.7	.403	15.8	.715	127.2
8050.0000	.720	125.0	.394	16.6	.395	16.6	.720	125.0
8100.0000	.751	124.1	.407	18.7	.407	18.7	.751	124.2
8150.0000	.754	122.5	.413	19.2	.413	19.4	.756	122.4
8200.0000	.774	125.1	.430	22.1	.430	22.2	.775	125.0
8250.0000	.794	125.5	.442	22.2	.442	22.3	.794	125.4
8300.0000	.777	125.9	.453	22.1	.453	22.2	.777	125.9
8350.0000	.783	123.8	.471	22.5	.471	22.4	.783	123.7
8400.0000	.768	123.3	.482	19.0	.482	19.0	.768	123.2
8450.0000	.746	124.3	.482	18.8	.482	18.8	.746	124.3
8500.0000	.739	125.4	.483	16.7	.483	16.9	.739	125.3
8550.0000	.713	125.8	.483	16.7	.483	16.9	.712	125.9
8600.0000	.709	124.5	.489	16.9	.489	17.0	.709	124.5
8650.0000	.693	121.9	.498	16.1	.498	16.2	.693	121.9
8700.0000	.696	120.1	.495	17.2	.495	17.3	.696	120.1
8750.0000	.697	120.6	.507	17.4	.507	17.5	.697	120.5
8800.0000	.688	121.3	.505	18.3	.505	18.5	.688	121.2
8850.0000	.684	120.4	.518	18.0	.518	18.0	.684	120.3
8900.0000	.678	118.6	.524	18.4	.524	18.4	.678	118.6
8950.0000	.682	117.8	.519	18.6	.519	18.7	.682	117.8
9000.0000	.675	117.0	.536	18.9	.536	18.9	.673	116.9
9050.0000	.679	117.4	.540	18.8	.540	18.7	.679	117.4
9100.0000	.675	117.8	.557	18.4	.557	18.5	.675	117.7
9150.0000	.667	116.8	.557	17.7	.559	17.7	.667	116.7
9200.0000	.661	115.1	.567	17.9	.567	17.8	.661	115.0
9250.0000	.656	113.9	.573	18.3	.572	18.3	.656	113.8
9300.0000	.651	113.8	.584	18.1	.584	18.0	.651	113.7
9350.0000	.645	113.6	.591	17.7	.591	17.8	.644	113.6
9400.0000	.643	112.9	.595	17.5	.595	17.5	.643	112.9
9450.0000	.640	112.0	.595	16.5	.595	16.6	.640	111.9
9500.0000	.639	111.4	.607	15.9	.607	15.9	.639	111.3
9550.0000	.641	110.9	.610	15.3	.610	15.3	.642	110.8
9600.0000	.639	110.7	.614	15.0	.614	15.1	.639	110.6
9650.0000	.637	109.3	.610	14.6	.610	14.6	.637	109.3
9700.0000	.633	107.3	.617	15.3	.617	15.3	.633	107.2
9750.0000	.634	106.1	.627	15.2	.627	15.1	.634	106.1
9800.0000	.634	106.3	.636	14.9	.636	15.0	.634	106.2
9850.0000	.634	107.5	.636	14.7	.636	14.7	.634	107.4
9900.0000	.633	107.8	.637	13.8	.637	13.8	.633	107.7
9950.0000	.628	106.4	.642	13.6	.642	13.7	.628	106.3
10000.0000	.630	106.1	.643	13.1	.643	13.0	.630	106.1

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM

COIL,ONR-38,#7

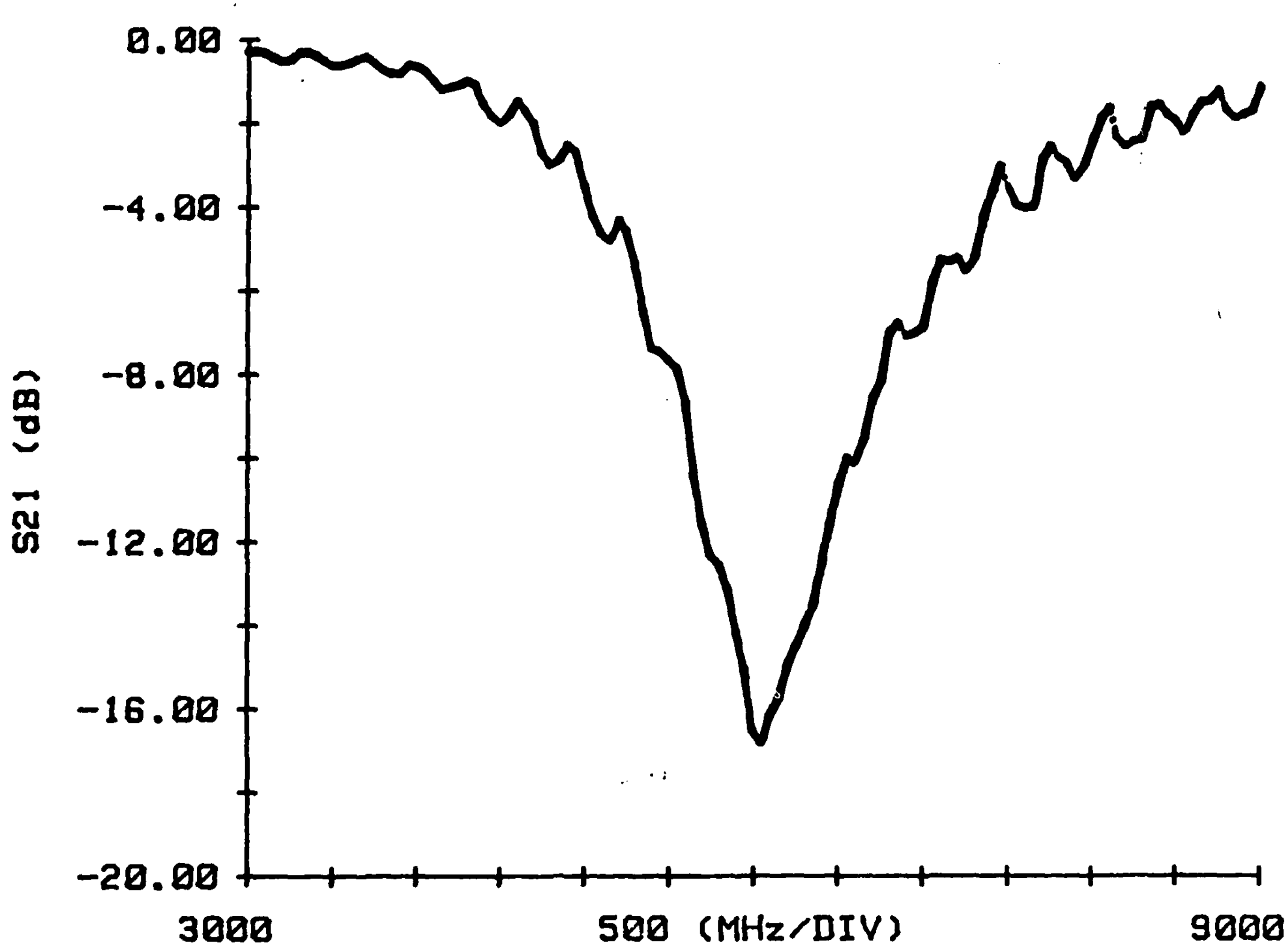


FREQUENCY	REFL COEFF -IN		LOSS-FORWARD		LOSS-REVERSE		REFL COEFF -OUT	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
3000.0000	.110	-104.3	.974	-17.1	.968	-17.0	.111	-104.4
3050.0000	.110	-105.9	.977	-18.3	.971	-18.3	.111	-106.0
3100.0000	.111	-107.5	.972	-19.4	.965	-19.6	.111	-107.8
3150.0000	.114	-110.0	.958	-19.8	.953	-19.9	.114	-109.9
3200.0000	.116	-112.0	.948	-19.0	.943	-18.9	.117	-111.9
3250.0000	.116	-114.0	.952	-19.0	.948	-18.9	.117	-113.9
3300.0000	.118	-115.5	.973	-19.8	.968	-19.7	.119	-115.6
3350.0000	.125	-117.6	.974	-20.9	.970	-20.8	.125	-117.6
3400.0000	.129	-119.9	.963	-22.7	.957	-22.6	.130	-120.0
3450.0000	.132	-122.2	.947	-23.3	.947	-23.2	.132	-122.1
3500.0000	.135	-124.1	.938	-23.1	.936	-23.1	.136	-124.2
3550.0000	.142	-125.5	.938	-23.0	.936	-22.9	.142	-125.6
3600.0000	.151	-126.9	.944	-23.1	.941	-23.1	.151	-126.9
3650.0000	.160	-129.4	.955	-24.1	.952	-24.0	.160	-129.3
3700.0000	.164	-131.3	.960	-25.4	.959	-25.3	.165	-131.3
3750.0000	.169	-133.1	.941	-27.5	.936	-27.4	.170	-133.1
3800.0000	.181	-134.5	.924	-28.3	.923	-28.2	.181	-134.5
3850.0000	.193	-134.6	.914	-27.2	.913	-27.1	.194	-134.5
3900.0000	.203	-136.8	.916	-26.4	.915	-26.4	.203	-136.8
3950.0000	.211	-139.1	.939	-27.7	.938	-27.7	.211	-139.3
4000.0000	.222	-139.8	.934	-30.1	.934	-30.1	.222	-139.9
4050.0000	.237	-139.8	.922	-32.8	.919	-32.6	.237	-139.7
4100.0000	.253	-141.6	.897	-32.9	.896	-32.8	.253	-141.6
4150.0000	.268	-142.7	.873	-32.9	.871	-32.8	.268	-142.7
4200.0000	.276	-144.3	.882	-31.7	.881	-31.5	.277	-144.2
4250.0000	.292	-145.8	.887	-32.1	.885	-31.9	.293	-145.8
4300.0000	.313	-145.8	.899	-34.4	.897	-34.3	.313	-145.7
4350.0000	.330	-147.0	.886	-37.5	.883	-37.4	.330	-147.0
4400.0000	.343	-149.2	.838	-39.9	.839	-39.8	.343	-149.2
4450.0000	.359	-149.4	.809	-40.1	.807	-40.2	.360	-149.5
4500.0000	.378	-151.2	.795	-39.0	.792	-38.8	.378	-151.2
4550.0000	.405	-152.0	.819	-39.7	.818	-39.3	.405	-152.0
4600.0000	.422	-153.4	.850	-39.8	.849	-39.6	.423	-153.4
4650.0000	.435	-154.7	.824	-44.4	.822	-44.3	.436	-154.7
4700.0000	.457	-156.1	.795	-47.1	.797	-47.0	.458	-156.2
4750.0000	.481	-157.7	.732	-46.9	.729	-46.6	.482	-157.7
4800.0000	.503	-159.1	.707	-45.6	.703	-45.3	.504	-159.1
4850.0000	.517	-160.6	.722	-44.7	.724	-44.6	.519	-160.5
4900.0000	.531	-161.3	.752	-46.2	.749	-46.0	.532	-161.4
4950.0000	.555	-163.3	.737	-50.9	.735	-50.7	.556	-163.3
5000.0000	.589	-165.1	.667	-54.5	.668	-54.3	.590	-165.1
5050.0000	.607	-166.5	.613	-56.0	.612	-56.1	.608	-166.5
5100.0000	.615	-167.9	.584	-52.1	.582	-51.9	.617	-167.9
5150.0000	.638	-170.0	.574	-52.2	.573	-52.0	.640	-170.1
5200.0000	.661	-171.9	.612	-54.1	.612	-54.0	.663	-172.0
5250.0000	.677	-172.8	.590	-58.4	.590	-58.4	.680	-172.9
5300.0000	.696	-174.9	.540	-63.4	.540	-63.1	.697	-175.0
5350.0000	.713	-177.1	.474	-62.1	.474	-61.8	.713	-177.1
5400.0000	.734	-178.9	.426	-60.5	.426	-60.5	.731	-179.0
5450.0000	.748	180.0	.424	-57.6	.424	-57.6	.746	180.0
5500.0000	.762	178.6	.414	-56.5	.414	-56.1	.761	178.5
5550.0000	.771	176.0	.405	-62.0	.405	-61.9	.775	176.0
5600.0000	.784	174.1	.367	-62.4	.367	-62.3	.787	174.0
5650.0000	.795	173.3	.302	-61.4	.302	-61.4	.795	173.3
5700.0000	.807	171.9	.264	-57.7	.264	-57.7	.809	172.0
5750.0000	.815	169.7	.242	-52.9	.242	-52.9	.817	169.7
5800.0000	.823	167.8	.235	-48.4	.235	-48.5	.822	167.7
5850.0000	.827	166.5	.220	-47.5	.220	-47.2	.831	166.4
5900.0000	.832	165.0	.196	-47.5	.197	-47.4	.834	165.0
5950.0000	.841	163.5	.177	-40.4	.176	-40.0	.839	163.5
6000.0000	.838	161.8	.149	-25.8	.149	-25.6	.841	161.8

6050.0000	.842	160.8	.144	-16.0	.144	-15.9	.843	160.7
6100.0000	.842	159.4	.157	-2.4	.158	-1.9	.843	159.4
6150.0000	.840	158.1	.165	6.0	.165	6.1	.840	158.0
6200.0000	.842	156.8	.181	8.8	.181	8.9	.845	156.7
6250.0000	.842	155.6	.190	13.3	.190	13.4	.842	155.6
6300.0000	.838	154.1	.201	19.9	.201	19.9	.845	154.0
6350.0000	.835	152.7	.213	28.3	.213	28.5	.836	152.8
6400.0000	.834	152.3	.239	34.4	.239	34.8	.831	152.3
6450.0000	.829	151.2	.266	35.7	.266	35.8	.832	151.1
6500.0000	.822	149.8	.296	32.6	.295	32.8	.824	149.8
6550.0000	.814	148.6	.319	30.6	.319	30.8	.818	148.5
6600.0000	.809	148.3	.313	31.6	.313	31.8	.813	148.2
6650.0000	.805	147.5	.335	32.0	.334	32.2	.807	147.5
6700.0000	.796	145.9	.375	38.5	.375	38.6	.800	145.8
6750.0000	.791	144.6	.394	41.1	.395	41.3	.790	144.5
6800.0000	.779	143.9	.450	36.8	.451	37.0	.783	143.8
6850.0000	.776	143.7	.462	35.3	.461	35.5	.778	143.7
6900.0000	.763	142.7	.444	32.5	.444	32.7	.765	142.7
6950.0000	.751	141.5	.449	34.4	.449	34.6	.752	141.4
7000.0000	.747	141.0	.456	37.1	.455	37.2	.748	140.9
7050.0000	.735	140.5	.514	37.2	.513	37.5	.735	140.5
7100.0000	.723	139.2	.549	37.0	.547	37.2	.725	139.1
7150.0000	.718	138.1	.546	30.2	.545	30.5	.718	137.9
7200.0000	.703	137.6	.552	27.5	.554	27.8	.703	137.6
7250.0000	.699	136.6	.529	30.1	.528	30.0	.698	136.5
7300.0000	.688	136.0	.552	30.8	.552	30.9	.691	136.2
7350.0000	.672	135.2	.617	34.1	.617	34.3	.671	135.1
7400.0000	.653	134.2	.664	32.2	.664	32.4	.654	134.2
7450.0000	.648	134.2	.710	27.1	.711	27.4	.653	134.0
7500.0000	.642	133.4	.664	25.3	.663	25.5	.642	133.3
7550.0000	.63[illegible]	131.7	.632	23.6	.633	23.7	.633	131.7
7600.0000	.620	130.9	.629	28.9	.630	29.0	.621	130.7
7650.0000	.602	129.3	.632	30.7	.634	30.9	.605	129.3
7700.0000	.595	129.0	.723	29.3	.722	29.4	.598	128.9
7750.0000	.583	129.0	.750	27.7	.749	27.8	.583	129.0
7800.0000	.575	127.8	.723	20.8	.722	21.1	.577	127.7
7850.0000	.569	125.3	.713	18.4	.713	18.6	.571	125.3
7900.0000	.557	125.3	.681	21.6	.681	21.8	.557	125.1
7950.0000	.535	124.3	.710	22.9	.710	23.2	.536	124.3
8000.0000	.532	124.1	.760	25.2	.760	25.5	.532	124.0
8050.0000	.530	122.9	.809	21.4	.811	21.7	.532	122.7
8100.0000	.520	120.6	.834	19.2	.833	19.5	.522	120.4
8150.0000	.506	119.2	.759	17.8	.758	18.0	.507	119.1
8200.0000	.492	119.7	.743	17.0	.745	17.3	.490	119.7
8250.0000	.479	118.9	.760	21.5	.758	21.6	.480	118.9
8300.0000	.485	117.2	.764	21.8	.761	22.0	.485	117.0
8350.0000	.477	116.2	.835	18.6	.832	18.8	.477	116.1
8400.0000	.459	114.6	.841	16.3	.839	16.5	.459	114.7
8450.0000	.453	113.0	.814	13.0	.816	13.3	.454	112.9
8500.0000	.447	112.0	.800	13.7	.799	13.8	.448	111.9
8550.0000	.439	111.3	.773	14.9	.771	15.1	.440	111.2
8600.0000	.440	110.0	.818	15.9	.818	16.1	.442	109.8
8650.0000	.437	109.4	.846	17.2	.845	17.5	.437	109.4
8700.0000	.425	107.5	.849	13.5	.849	13.9	.424	107.4
8750.0000	.421	106.5	.872	12.1	.873	12.2	.423	106.5
8800.0000	.414	106.7	.822	11.3	.823	11.6	.415	106.3
8850.0000	.408	105.2	.804	11.2	.803	11.3	.410	105.1
8900.0000	.412	103.6	.815	12.3	.814	12.5	.412	103.6
8950.0000	.404	102.9	.824	11.7	.823	12.1	.404	102.8
9000.0000	.392	101.5	.883	10.8	.881	11.0	.392	101.4

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM

COIL NØ #1.



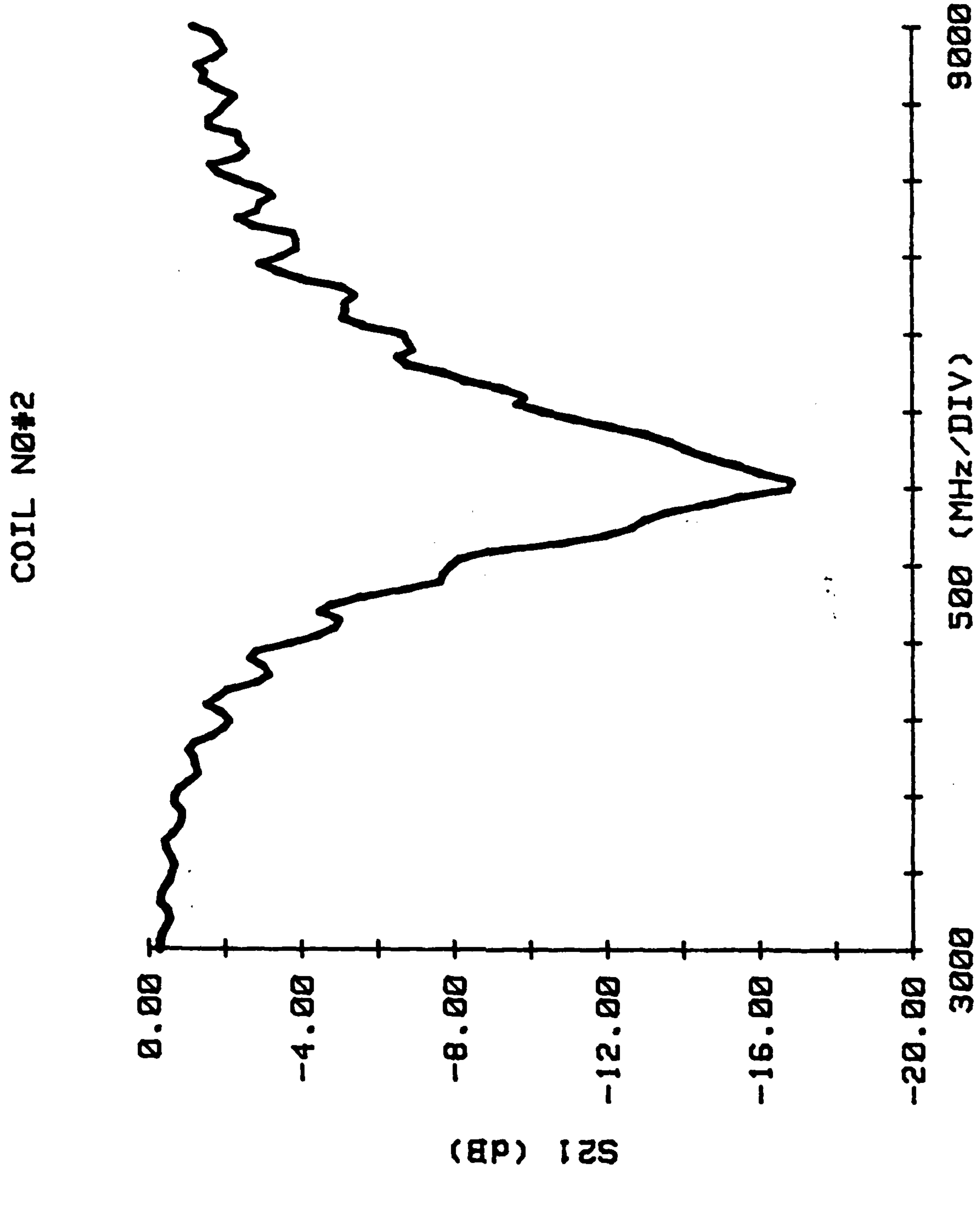
COIL NO#2

12:22:5   9 MAR 81

FREQUENCY	REFL COEFF -IN		LOSS-FORWARD		LOSS-REVERSE		REFL COEFF -OUT	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
3000.0000	.119	-104.9	.975	-18.1	.970	-18.1	.120	-105.0
3050.0000	.119	-106.6	.973	-19.5	.975	-19.5	.120	-106.9
3100.0000	.121	-108.6	.968	-20.8	.968	-20.9	.121	-108.8
3150.0000	.124	-111.0	.956	-21.1	.953	-21.1	.124	-111.1
3200.0000	.127	-113.2	.946	-20.1	.945	-20.1	.127	-113.2
3250.0000	.127	-115.4	.952	-20.2	.951	-20.0	.128	-115.4
3300.0000	.130	-117.0	.975	-21.0	.973	-21.0	.131	-117.1
3350.0000	.137	-119.4	.972	-22.2	.972	-22.2	.137	-119.4
3400.0000	.142	-121.7	.960	-24.1	.964	-24.0	.142	-121.9
3450.0000	.145	-124.1	.944	-24.7	.946	-24.6	.146	-124.1
3500.0000	.148	-126.1	.938	-24.4	.940	-24.5	.149	-126.3
3550.0000	.155	-127.5	.933	-24.3	.933	-24.2	.156	-127.6
3600.0000	.165	-129.1	.943	-24.4	.940	-24.4	.166	-129.1
3650.0000	.175	-131.6	.955	-25.4	.956	-25.3	.176	-131.5
3700.0000	.180	-133.5	.959	-26.9	.961	-27.0	.181	-133.5
3750.0000	.185	-135.4	.937	-29.1	.939	-29.1	.186	-135.5
3800.0000	.197	-136.8	.919	-30.0	.923	-29.9	.198	-136.9
3850.0000	.211	-136.8	.912	-28.7	.910	-28.7	.212	-136.7
3900.0000	.221	-139.1	.911	-28.1	.914	-27.8	.222	-139.1
3950.0000	.228	-141.5	.935	-29.3	.938	-29.2	.230	-141.6
4000.0000	.239	-142.1	.932	-31.7	.935	-31.6	.240	-142.3
4050.0000	.254	-142.4	.920	-34.5	.921	-34.3	.254	-142.4
4100.0000	.272	-144.1	.892	-34.7	.892	-34.6	.272	-144.1
4150.0000	.287	-145.2	.866	-34.6	.864	-34.6	.288	-145.2
4200.0000	.295	-146.7	.876	-33.3	.880	-33.2	.296	-146.8
4250.0000	.311	-148.3	.880	-33.7	.882	-33.7	.312	-148.3
4300.0000	.332	-148.3	.893	-36.0	.894	-36.0	.333	-148.4
4350.0000	.349	-149.4	.878	-39.4	.879	-39.3	.350	-149.4
4400.0000	.362	-151.6	.831	-41.6	.832	-41.6	.364	-151.6
4450.0000	.378	-151.9	.800	-42.0	.798	-42.0	.379	-151.9
4500.0000	.397	-153.4	.787	-40.5	.788	-40.5	.397	-153.5
4550.0000	.424	-154.5	.810	-41.4	.811	-41.3	.425	-154.5
4600.0000	.442	-155.7	.846	-41.3	.842	-41.2	.443	-155.8
4650.0000	.454	-157.0	.816	-46.2	.815	-46.1	.456	-157.1
4700.0000	.476	-158.5	.790	-49.0	.789	-49.0	.477	-158.6
4750.0000	.499	-160.0	.722	-48.5	.719	-48.6	.500	-160.0
4800.0000	.521	-161.2	.697	-47.2	.694	-47.2	.522	-161.2
4850.0000	.536	-162.7	.713	-46.5	.714	-46.4	.537	-162.7
4900.0000	.548	-163.5	.741	-47.8	.742	-47.9	.549	-163.6
4950.0000	.570	-165.4	.727	-52.7	.727	-52.6	.572	-165.4
5000.0000	.605	-167.1	.655	-56.2	.655	-56.2	.606	-167.2
5050.0000	.617	-168.5	.601	-57.9	.601	-57.9	.619	-168.5
5100.0000	.635	-170.0	.571	-53.7	.572	-53.7	.636	-170.1
5150.0000	.652	-171.9	.562	-53.9	.564	-53.9	.653	-171.9
5200.0000	.676	-173.7	.601	-56.0	.601	-56.1	.677	-173.8
5250.0000	.690	-174.5	.578	-60.3	.576	-60.3	.692	-174.7
5300.0000	.708	-176.5	.527	-64.9	.528	-65.0	.710	-176.5
5350.0000	.726	-178.7	.463	-63.7	.464	-63.5	.726	-178.9
5400.0000	.742	179.6	.415	-61.8	.415	-61.8	.742	179.4
5450.0000	.757	178.4	.412	-59.0	.414	-59.0	.759	178.4
5500.0000	.771	177.1	.403	-57.9	.402	-57.7	.770	177.0
5550.0000	.781	174.6	.392	-63.3	.392	-63.4	.783	174.6
5600.0000	.792	172.7	.354	-63.7	.355	-63.6	.794	172.6
5650.0000	.802	172.1	.290	-62.4	.289	-62.2	.805	172.0
5700.0000	.818	170.7	.253	-58.3	.253	-58.2	.815	170.6
5750.0000	.822	168.4	.233	-53.0	.233	-53.0	.822	168.4
5800.0000	.829	166.6	.225	-48.6	.225	-48.4	.830	166.6
5850.0000	.836	165.4	.210	-47.0	.210	-46.7	.834	165.3
5900.0000	.837	164.0	.187	-46.4	.187	-46.2	.840	163.9
5950.0000	.844	162.5	.170	-38.2	.169	-38.0	.845	162.5
6000.0000	.843	160.8	.146	-23.2	.146	-23.0	.846	160.8

6050.0000	.845	159.7	.144	-12.8	.144	-12.4	.848	159.7
6100.0000	.845	158.5	.160	.1	.160	.4	.847	158.5
6150.0000	.843	157.2	.171	8.2	.172	8.4	.845	157.2
6200.0000	.844	155.9	.187	10.4	.187	10.4	.846	155.7
6250.0000	.845	154.8	.199	14.2	.199	14.2	.843	154.7
6300.0000	.843	153.3	.210	20.3	.209	20.3	.844	153.3
6350.0000	.833	151.9	.225	28.2	.226	28.3	.834	151.8
6400.0000	.830	151.5	.251	33.9	.252	34.1	.832	151.5
6450.0000	.830	150.4	.280	34.7	.281	34.7	.832	150.4
6500.0000	.819	149.2	.308	31.1	.308	31.2	.825	149.1
6550.0000	.812	148.0	.332	28.9	.332	29.0	.815	147.9
6600.0000	.807	147.6	.323	30.2	.323	30.1	.808	147.6
6650.0000	.804	147.0	.347	30.4	.347	30.4	.804	146.8
6700.0000	.796	145.3	.389	36.5	.388	36.6	.797	145.2
6750.0000	.789	144.2	.414	38.6	.413	38.7	.788	143.9
6800.0000	.778	143.4	.461	34.4	.461	34.5	.779	143.2
6850.0000	.770	143.2	.475	32.3	.475	32.3	.772	143.1
6900.0000	.761	142.3	.452	30.5	.452	30.6	.758	142.1
6950.0000	.748	141.0	.460	32.0	.459	32.1	.749	141.0
7000.0000	.743	140.5	.467	34.9	.466	35.0	.744	140.4
7050.0000	.731	140.2	.527	34.6	.527	34.7	.734	140.0
7100.0000	.723	138.9	.560	34.0	.561	34.1	.721	138.7
7150.0000	.714	137.8	.555	27.7	.555	27.8	.716	137.7
7200.0000	.702	137.4	.556	25.1	.556	25.2	.702	137.1
7250.0000	.695	136.4	.538	27.7	.538	27.8	.696	136.2
7300.0000	.685	135.8	.561	28.7	.561	28.7	.685	135.8
7350.0000	.669	135.0	.633	30.9	.634	31.0	.669	134.9
7400.0000	.648	134.1	.678	29.1	.675	29.2	.651	133.8
7450.0000	.650	133.9	.718	23.4	.718	23.5	.650	133.7
7500.0000	.641	133.2	.671	22.3	.668	22.3	.638	133.1
7550.0000	.630	131.5	.640	21.1	.638	21.1	.629	131.3
7600.0000	.615	130.6	.642	26.1	.642	26.1	.616	130.5
7650.0000	.597	129.3	.649	28.2	.648	28.3	.599	129.0
7700.0000	.594	128.8	.733	25.9	.735	25.9	.596	128.5
7750.0000	.581	128.9	.766	24.1	.765	24.0	.584	128.6
7800.0000	.576	127.6	.721	17.7	.722	17.8	.574	127.3
7850.0000	.568	125.0	.716	15.3	.716	15.3	.567	124.8
7900.0000	.556	124.6	.686	19.3	.686	19.2	.556	124.6
7950.0000	.535	124.0	.719	19.9	.721	19.9	.535	123.8
8000.0000	.532	123.6	.773	22.1	.771	22.2	.533	123.4
8050.0000	.532	122.1	.815	17.6	.817	17.8	.532	121.9
8100.0000	.522	119.8	.834	15.5	.836	15.5	.522	119.6
8150.0000	.507	118.5	.761	14.3	.760	14.6	.507	118.2
8200.0000	.494	119.0	.741	14.1	.740	14.1	.494	118.9
8250.0000	.482	118.4	.764	18.2	.767	18.3	.483	118.1
8300.0000	.488	116.1	.767	18.7	.765	18.8	.490	115.9
8350.0000	.483	114.9	.837	14.9	.836	14.9	.484	114.7
8400.0000	.460	113.7	.835	12.7	.835	12.8	.462	113.3
8450.0000	.456	111.8	.808	9.5	.806	9.6	.456	111.5
8500.0000	.453	111.0	.792	10.8	.793	10.8	.454	110.6
8550.0000	.446	110.2	.770	11.8	.769	11.9	.445	109.6
8600.0000	.448	108.5	.816	12.8	.816	12.9	.448	108.2
8650.0000	.444	107.6	.851	14.0	.849	14.0	.447	107.3
8700.0000	.433	105.9	.846	10.3	.847	10.3	.434	105.7
8750.0000	.430	105.2	.867	8.5	.868	8.7	.430	104.7
8800.0000	.425	104.7	.818	8.5	.817	8.5	.427	104.5
8850.0000	.419	103.4	.795	8.1	.797	8.2	.420	103.1
8900.0000	.423	101.6	.809	9.6	.809	9.5	.424	101.5
8950.0000	.415	101.0	.822	8.7	.821	8.8	.415	100.6
9000.0000	.403	99.5	.877	7.5	.881	7.5	.403	99.1

INPUT REF = 4.74 CM   OUTPUT REF = 4.74 CM


COIL NØ#2
S21 (dB)
0.00
-4.00
-8.00
-12.00
-16.00
-20.00
3000
500 (MHz/DIV)
9000

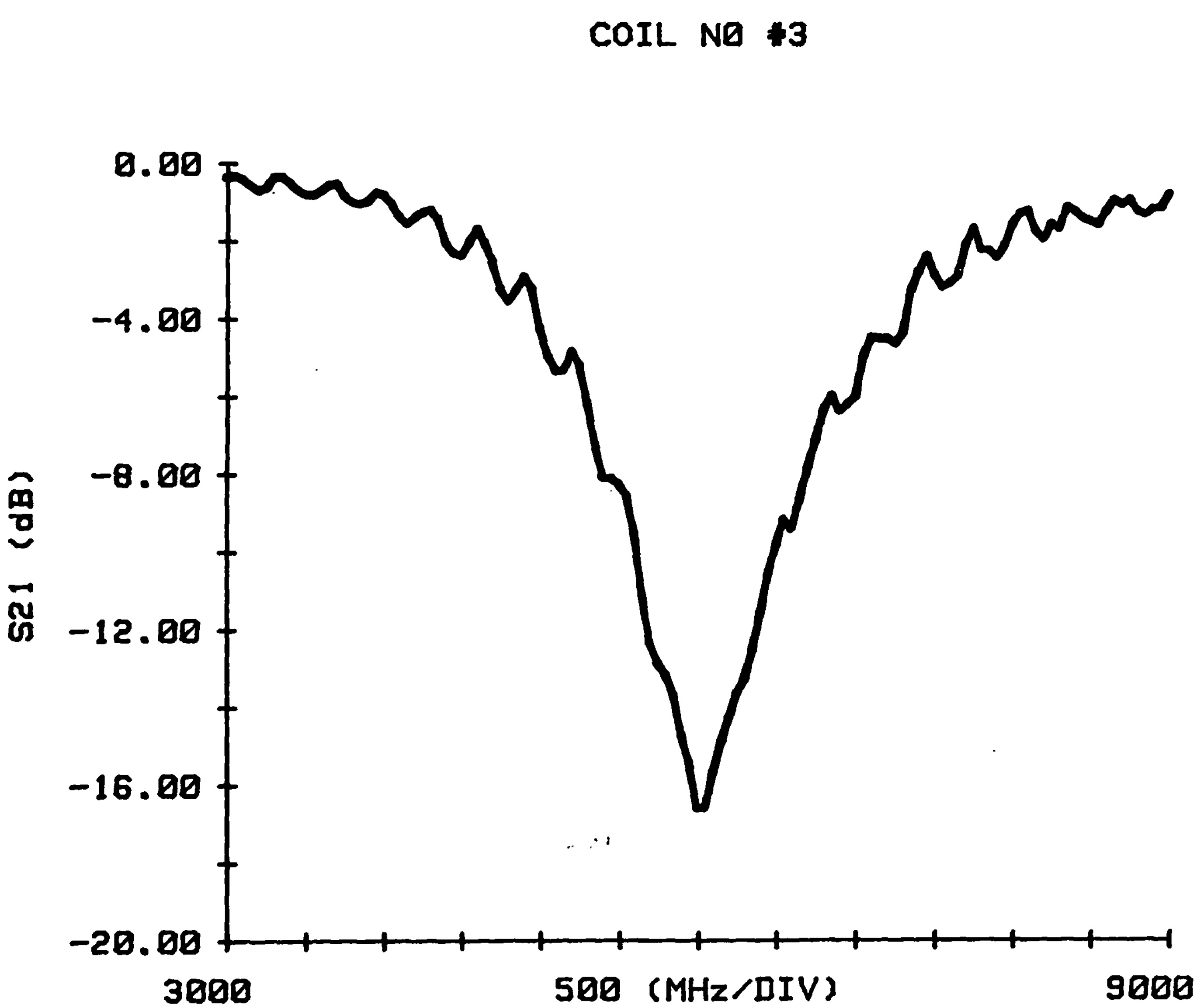
COIL NO #3

12:27:52 9 MAR 81

FREQUENCY	REFL COEFF -IN		LOSS-FORWARD		LOSS-REVERSE		REFL COEFF -OUT	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
3000.0000	.172	-114.1	.965	-20.3	.966	-20.2	.174	-114.2
3050.0000	.172	-114.9	.971	-22.1	.967	-22.0	.174	-115.2
3100.0000	.175	-115.5	.962	-23.6	.961	-23.6	.176	-115.8
3150.0000	.181	-116.5	.944	-23.8	.944	-23.9	.181	-116.6
3200.0000	.186	-117.4	.928	-22.5	.930	-22.5	.186	-117.1
3250.0000	.185	-118.6	.937	-22.3	.939	-22.4	.187	-118.2
3300.0000	.189	-118.9	.967	-23.3	.964	-23.3	.191	-118.7
3350.0000	.197	-120.1	.968	-24.6	.968	-24.7	.199	-119.7
3400.0000	.203	-121.1	.951	-27.1	.951	-27.1	.205	-120.9
3450.0000	.206	-122.3	.928	-27.6	.929	-27.7	.208	-122.2
3500.0000	.209	-123.2	.916	-27.1	.913	-27.2	.210	-123.3
3550.0000	.218	-123.5	.916	-26.7	.917	-26.6	.218	-123.6
3600.0000	.230	-124.1	.929	-26.7	.926	-26.7	.230	-124.2
3650.0000	.239	-125.8	.944	-28.2	.944	-28.3	.239	-125.7
3700.0000	.243	-126.8	.948	-30.1	.946	-30.1	.244	-126.7
3750.0000	.247	-127.5	.910	-32.4	.911	-32.3	.248	-127.4
3800.0000	.261	-128.5	.893	-33.1	.892	-33.0	.262	-128.6
3850.0000	.276	-128.7	.890	-31.2	.889	-31.2	.276	-128.7
3900.0000	.283	-130.2	.899	-30.3	.899	-30.3	.284	-130.3
3950.0000	.288	-132.4	.923	-31.9	.923	-31.8	.289	-132.5
4000.0000	.301	-132.8	.916	-35.2	.917	-35.1	.302	-132.9
4050.0000	.319	-132.3	.892	-37.7	.893	-37.7	.320	-132.5
4100.0000	.333	-134.0	.859	-38.0	.857	-38.0	.333	-133.9
4150.0000	.346	-135.5	.838	-37.1	.836	-37.1	.347	-135.4
4200.0000	.354	-136.7	.856	-35.8	.854	-35.9	.356	-136.7
4250.0000	.368	-137.9	.870	-36.1	.870	-36.1	.370	-138.0
4300.0000	.391	-137.9	.877	-39.6	.881	-39.6	.392	-137.9
4350.0000	.406	-139.2	.850	-42.7	.852	-42.8	.407	-139.2
4400.0000	.415	-141.3	.790	-44.7	.791	-44.8	.416	-141.4
4450.0000	.433	-141.8	.768	-44.0	.765	-43.8	.434	-142.0
4500.0000	.451	-143.1	.762	-42.8	.761	-43.0	.451	-143.2
4550.0000	.476	-144.2	.794	-43.6	.795	-43.6	.477	-144.2
4600.0000	.491	-145.9	.827	-45.1	.825	-45.1	.492	-145.9
4650.0000	.503	-146.9	.792	-49.5	.791	-49.5	.504	-147.0
4700.0000	.522	-148.6	.747	-52.3	.746	-52.3	.523	-148.7
4750.0000	.544	-150.0	.689	-50.8	.689	-50.9	.545	-150.1
4800.0000	.563	-151.5	.665	-48.7	.662	-49.0	.564	-151.6
4850.0000	.572	-152.8	.690	-48.7	.690	-48.7	.574	-152.9
4900.0000	.585	-153.9	.718	-51.3	.716	-51.2	.587	-154.0
4950.0000	.607	-155.7	.690	-55.8	.692	-55.9	.608	-155.8
5000.0000	.638	-157.6	.613	-59.1	.614	-59.0	.632	-158.0
5050.0000	.648	-159.2	.565	-59.4	.565	-59.4	.648	-159.2
5100.0000	.660	-160.7	.541	-55.2	.541	-55.2	.663	-160.6
5150.0000	.676	-162.5	.543	-54.9	.544	-54.8	.676	-162.6
5200.0000	.697	-164.5	.575	-57.9	.574	-58.1	.694	-164.6
5250.0000	.709	-165.7	.550	-62.6	.549	-62.5	.709	-165.7
5300.0000	.725	-167.5	.492	-66.1	.492	-66.0	.728	-167.6
5350.0000	.740	-169.9	.433	-64.1	.432	-63.8	.740	-169.8
5400.0000	.755	-171.6	.395	-61.4	.394	-61.3	.753	-171.7
5450.0000	.766	-172.7	.395	-58.4	.394	-58.3	.767	-172.8
5500.0000	.777	-174.2	.388	-58.1	.388	-58.1	.777	-174.4
5550.0000	.784	-176.8	.374	-63.1	.374	-63.1	.785	-177.0
5600.0000	.793	-178.8	.334	-64.1	.334	-64.0	.797	-178.9
5650.0000	.801	-179.6	.279	-61.1	.278	-61.0	.803	-179.6
5700.0000	.815	178.9	.242	-56.8	.242	-56.7	.814	179.0
5750.0000	.819	176.4	.228	-51.3	.228	-51.1	.819	176.4
5800.0000	.823	174.4	.220	-47.0	.220	-47.0	.828	174.4
5850.0000	.830	173.2	.207	-45.0	.207	-45.0	.832	173.1
5900.0000	.831	171.8	.185	-44.7	.185	-44.4	.833	171.6
5950.0000	.836	169.9	.169	-35.4	.170	-35.2	.834	170.0
6000.0000	.837	168.0	.149	-20.7	.148	-20.4	.835	168.0

6050.0000	.836	166.8	.149	-9.7	.150	-9.6	.840	166.8
6100.0000	.834	165.4	.166	1.7	.166	1.9	.836	165.4
6150.0000	.834	164.0	.181	9.8	.181	10.0	.835	163.9
6200.0000	.830	162.4	.195	11.1	.195	11.3	.829	162.3
6250.0000	.832	161.0	.210	14.5	.210	14.4	.829	160.8
6300.0000	.828	159.4	.219	20.7	.219	20.6	.828	159.4
6350.0000	.817	158.0	.239	27.9	.239	27.8	.817	157.9
6400.0000	.814	157.3	.265	33.5	.267	33.5	.813	157.3
6450.0000	.811	156.0	.298	33.9	.299	34.0	.814	155.9
6500.0000	.797	154.5	.324	29.8	.324	29.8	.800	154.4
6550.0000	.789	153.1	.350	27.9	.351	28.0	.789	153.0
6600.0000	.782	152.6	.339	28.9	.339	29.0	.783	152.6
6650.0000	.775	151.6	.371	29.3	.371	29.4	.773	151.5
6700.0000	.765	149.7	.408	34.9	.409	34.9	.766	149.7
6750.0000	.753	148.5	.443	36.5	.444	36.5	.755	148.4
6800.0000	.742	147.6	.484	32.6	.485	32.6	.742	147.5
6850.0000	.732	147.2	.505	29.7	.506	29.8	.733	147.2
6900.0000	.717	146.1	.480	28.7	.481	28.8	.720	145.9
6950.0000	.703	144.5	.492	29.8	.491	29.8	.706	144.6
7000.0000	.696	144.0	.503	32.5	.503	32.5	.696	143.8
7050.0000	.681	143.6	.566	31.6	.565	31.7	.681	143.5
7100.0000	.668	141.9	.599	30.8	.599	30.8	.668	141.9
7150.0000	.657	140.8	.596	25.0	.594	25.0	.658	140.7
7200.0000	.643	140.4	.595	22.8	.594	22.8	.645	140.4
7250.0000	.629	139.3	.587	24.8	.586	24.9	.629	139.3
7300.0000	.619	138.7	.607	25.7	.607	25.8	.619	138.7
7350.0000	.598	137.9	.688	26.4	.687	26.4	.598	138.0
7400.0000	.577	137.2	.727	24.8	.725	24.8	.578	137.4
7450.0000	.573	136.7	.762	19.1	.760	19.2	.572	136.9
7500.0000	.559	136.3	.718	18.6	.721	18.8	.561	136.2
7550.0000	.546	134.4	.691	17.3	.693	17.3	.544	134.3
7600.0000	.526	133.9	.702	21.2	.701	21.3	.528	133.8
7650.0000	.507	132.7	.717	22.8	.716	22.9	.509	132.8
7700.0000	.503	132.4	.786	19.8	.784	19.9	.501	132.3
7750.0000	.493	132.6	.824	17.5	.825	17.6	.493	132.7
7800.0000	.477	131.7	.772	13.1	.773	13.3	.477	131.7
7[illegible].0000	.461	128.9	.772	10.4	.773	10.7	.461	129.2
7900.0000	.449	129.5	.753	14.3	.751	14.2	.451	129.3
7950.0000	.429	129.0	.783	13.4	.783	13.6	.431	129.1
8000.0000	.424	128.7	.833	14.9	.831	15.1	.424	128.6
8050.0000	.415	127.2	.862	10.5	.862	10.6	.415	127.2
8100.0000	.394	125.7	.868	8.9	.867	9.0	.394	125.7
8150.0000	.382	125.4	.815	8.5	.815	8.5	.382	125.4
8200.0000	.378	126.7	.795	8.5	.796	8.4	.378	126.7
8250.0000	.366	125.9	.833	10.6	.834	10.7	.366	125.9
8300.0000	.361	123.2	.822	11.0	.823	11.2	.361	123.3
8350.0000	.351	122.5	.878	6.7	.879	6.7	.351	122.5
8400.0000	.338	123.1	.864	6.1	.863	6.2	.338	123.1
8450.0000	.326	121.6	.848	3.0	.847	3.0	.325	121.6
8500.0000	.322	120.9	.840	4.8	.840	4.9	.322	121.0
8550.0000	.309	120.6	.831	4.7	.830	4.8	.309	120.6
8600.0000	.306	119.6	.866	5.3	.863	5.5	.306	119.6
8650.0000	.307	119.0	.895	4.9	.897	5.0	.307	119.1
8700.0000	.297	118.3	.881	3.3	.879	3.4	.297	118.3
8750.0000	.286	117.7	.895	1.2	.895	1.3	.286	117.7
8800.0000	.283	117.4	.865	2.4	.865	2.4	.283	117.4
8850.0000	.280	117.6	.856	1.2	.854	1.4	.280	117.7
8900.0000	.278	115.3	.872	3.0	.872	3.0	.279	115.4
8950.0000	.269	116.4	.874	.6	.874	.7	.269	116.4
9000.0000	.255	116.6	.911	.3	.909	.3	.255	116.6

INPUT REF = 4.74 CM OUTPUT REF = 4.74 CM


COIL NØ #3
S21 (dB)
0.00
-4.00
-8.00
-12.00
-16.00
-20.00
3000
500 (MHz/DIV)
9000

APPENDIX C

[illegible] [illegible] 1980

[illegible] PREAMP

Stage 1+2 5mil/s
Last 6 10mil/s

[illegible] VOLTS, [illegible] MA [illegible] OWR PREAMP [illegible] #

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	[illegible]	[illegible]	.010	-99	.008	-109	.651	-7
2200.000	[illegible]	42	[illegible]	-160	.018	-153	.613	-36
2400.000	[illegible]	[illegible]	[illegible]	92	.014	101	.623	-63
2600.000	[illegible]	-11	[illegible]	-163	.001	-137	.616	-90
2800.000	[illegible]	-54	[illegible]	197	.003	169	[illegible]	-118
3000.000	[illegible]	[illegible]	[illegible]	-31	.005	132	[illegible]	[illegible]
3200.000	.551	-130	1.[illegible]	169	.005	106	.527	-172
3400.000	.561	-161	2.[illegible]	36	.003	78	.516	131
3600.000	.383	170	4.[illegible]	-124	.003	37	.503	133
3800.000	.727	155	1.114	90	.006	74	.493	103
4000.000	.706	117	.945	31	.005	38	.325	79
4200.000	.678	83	.708	-47	.005	-6	.629	51
4400.000	.546	38	.560	-131	.003	-13	.575	27
4600.000	.592	96	.305	-155	.008	-10	.545	5
4800.000	.765	28	.447	122	.007	-52	.512	-10
5000.000	.744	-0	.433	53	.007	-71	.475	-41
5200.000	.707	-39	.429	-11	.007	-85	.336	-64
5400.000	.647	-69	.414	-71	.008	-102	.236	-35
5600.000	.551	-99	.436	-126	.010	-131	.210	-63
5800.000	.421	-126	.499	172	.009	-153	.278	-81
6000.000	.288	-146	.533	104	.009	-162	.292	-105
6200.000	.206	-151	.544	29	.011	-176	.275	-129
6400.000	.199	-154	.588	-52	.015	162	.250	-155
6600.000	.210	-175	.754	-142	.019	135	.234	170
6800.000	.156	147	.939	108	.023	95	.223	105
7000.000	.071	147	.681	-3	.017	63	.170	16
7200.000	.064	136	.318	-70	.016	54	.174	-47
7400.000	.030	97	.222	-97	.017	42	.209	-90
7600.000	.012	-46	.299	-142	.021	25	.248	-123
7800.000	.020	-35	.379	150	.025	3	.290	-152
8000.000	.038	-51	.330	74	.025	-17	.312	176
8200.000	.078	-70	.232	4	.029	-39	.330	144
8400.000	.130	-97	.137	-52	.033	-55	.338	112
8600.000	.189	-122	.078	-77	.043	-73	.336	82
8800.000	.212	-144	.094	-96	.060	-97	.336	54
9000.000	.233	-166	.110	-117	.080	-129	.343	26
9200.000	.232	170	.130	-154	.100	-164	.385	-2
9400.000	.210	141	.140	166	.116	158	.399	-31
9600.000	.175	107	.146	120	.126	120	.424	-59
9800.000	.112	61	.112	90	.127	89	.462	-87
10000.00	.072	-26	.129	54	.118	41	.508	-114
10200.00	.122	-113	.110	22	.098	5	.555	-140
10400.00	.130	-133	.133	-4	.072	-26	.622	-164
10600.00	[illegible]	145	[illegible]	-30	.050	-38	.625	172
10800.00	[illegible]	35	[illegible]	-21	.055	-44	.674	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.050	-67	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-74	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.050	-34	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	-1[illegible]	.092	-109	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.112	-109	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.127	-139	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.110	131	[illegible]	[illegible]

12400.00	.322	102	.192	103	.152	130	.450	4
12600.00	.401	87	.102	71	.155	98	.405	-17
12800.00	.433	61	.158	46	.150	72	.377	-38
13000.00	.378	30	.163	23	.165	50	.385	-62
13200.00	.264	-4	.194	2	.194	20	.401	-91
13400.00	.133	-54	.215	-32	.214	-15	.420	-120
13600.00	.096	-171	.218	-63	.216	-53	.450	-148
13800.00	.209	120	.206	-103	.204	-92	.492	-174
14000.00	.305	77	.174	-143	.171	-130	.540	159
14200.00	.362	39	.137	-170	.132	-164	.592	130
14400.00	.394	4	.095	153	.090	166	.639	105
14600.00	.403	-27	.058	133	.050	149	.684	78
14800.00	.390	-55	.038	140	.037	162	.719	51
15000.00	.362	-81	.046	152	.051	171	.747	26
15200.00	.316	-106	.066	140	.075	155	.759	2
15400.00	.258	-130	.089	113	.100	129	.753	-19
15600.00	.193	-153	.112	91	.122	100	.732	-40
15800.00	.134	-174	.129	69	.134	69	.696	-58
16000.00	.100	144	.138	38	.142	44	.649	-76
16200.00	.069	72	.159	5	.164	14	.590	-93
16400.00	.098	10	.171	-26	.169	-16	.538	-110
16600.00	.124	-27	.192	-56	.190	-42	.460	-129
[illegible]	.125	-52	.214	[illegible]	.225	-76	.345	-143
[illegible]	.130	-56	[illegible]	[illegible]	[illegible]	[illegible]	.271	-146
[illegible]	.145	-59	[illegible]	[illegible]	[illegible]	[illegible]	.220	-152
[illegible]	.176	-61	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-163
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.237	170

[illegible]

MAY [illegible]

[illegible] PREAMP

.[illegible] VOLTS, .[illegible] MA (MEAS 1) 10MA PER STAGE

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	[illegible]	27	.011	-38	.006	-113	.702	-10
2200.000	[illegible]	35	[illegible]	-161	.014	-152	.703	-38
2400.000	[illegible]	21	.015	94	.011	88	.639	-66
2600.000	[illegible]	-14	.019	165	.001	-132	.638	-94
2800.000	[illegible]	-54	[illegible]	80	.003	155	.671	-124
3000.000	[illegible]	-93	[illegible]	-60	.004	133	.661	[illegible]
3200.000	.548	-127	1.699	148	.005	85	.824	170
3400.000	.544	-163	2.079	14	.002	57	.639	129
3600.000	.822	165	4.202	-145	.003	70	.401	137
3800.000	.704	151	1.169	87	.006	63	.504	114
4000.000	.688	108	1.011	21	.006	20	.630	81
4200.000	.669	72	.859	-69	.004	-8	.611	51
4400.000	.568	27	.695	-143	.002	-21	.554	20
4600.000	.528	97	.339	-179	.009	-7	.527	6
4800.000	.744	20	.329	105	.007	-54	.510	-17
5000.000	.705	-16	.516	36	.006	-71	.468	-40
5200.000	.642	-46	.496	-23	.006	-86	.337	[illegible]
5400.000	.540	-76	.462	-88	.007	-99	.244	[illegible]
5600.000	.427	-104	.460	-144	.008	-122	.214	-66
5800.000	.298	-127	.504	154	.009	-139	.206	-80
6000.000	.187	-140	.510	85	.010	-153	.300	-103
6200.000	.137	-142	.506	10	.013	-171	.231	-120
6400.000	.126	-151	.545	-72	.016	167	.259	-155
6600.000	.110	175	.703	-164	.020	140	.221	170
6800.000	.068	83	.333	88	.023	103	.187	107
7000.000	.070	-30	.649	-20	.019	72	.139	13
7200.000	.076	-77	.387	-88	.018	61	.155	-51
7400.000	.091	-96	.204	-118	.021	46	.194	-92
7600.000	.105	-120	.254	-161	.025	27	.234	-126
7800.000	.097	-155	.291	133	.029	5	.279	-156
8000.000	.061	179	.263	61	.032	-19	.329	173
8200.000	.099	-157	.193	-5	.035	-39	.366	141
8400.000	.066	-143	.122	-57	.041	-58	.384	111
8600.000	.093	-159	.078	-82	.052	-79	.384	[illegible]
8800.000	.120	-175	.085	-95	.069	-105	.376	74
9000.000	.144	165	.108	-126	.088	-137	.373	26
9200.000	.162	141	.126	-162	.107	-172	.376	-2
9400.000	.151	111	.136	160	.121	151	.392	-31
9600.000	.130	72	.140	123	.131	113	.420	-60
9800.000	.111	13	.136	85	.131	75	.459	-83
10000.00	.126	-61	.124	59	.121	36	.506	-114
10200.00	.184	-110	.135	18	.100	0	.554	-140
10400.00	.248	-164	.094	-6	.074	-30	.589	-164
10600.00	.251	172	.071	-23	.052	-45	.631	[illegible]
10800.00	.198	[illegible]	[illegible]	-30	.053	-51	.651	150
11000.00	[illegible]	[illegible]	[illegible]	[illegible]	.043	-72	[illegible]	[illegible]
11200.00	[illegible]	[illegible]	[illegible]	[illegible]	.044	-74	[illegible]	[illegible]
11400.00	[illegible]	[illegible]	[illegible]	-120	.070	-85	[illegible]	[illegible]
11600.00	[illegible]	[illegible]	[illegible]	-131	.095	-112	[illegible]	71
11800.00	[illegible]	[illegible]	[illegible]	[illegible]	.113	-142	[illegible]	[illegible]
12000.00	[illegible]	[illegible]	[illegible]	[illegible]	.131	-173	[illegible]	[illegible]
12200.00	[illegible]	[illegible]	[illegible]	135	.143	157	[illegible]	[illegible]

12400.00	.320	86	.194	103	.154	126	.446	3
12600.00	.389	72	.185	71	.155	95	.396	-17
12800.00	.428	46	.163	46	.151	69	.367	-38
13000.00	.388	14	.169	27	.160	46	.375	-63
13200.00	.295	-22	.199	-0	.196	16	.393	-93
13400.00	.187	-68	.217	-34	.215	-19	.418	-122
13600.00	.109	-148	.218	-71	.217	-57	.452	-149
13800.00	.156	119	.204	-108	.203	-95	.495	-174
14000.00	.251	64	.172	-144	.174	-133	.544	160
14200.00	.328	22	.134	-179	.136	-169	.592	133
14400.00	.385	-12	.093	152	.095	132	.635	105
14600.00	.400	-40	.057	132	.057	142	.678	77
14800.00	.402	-65	.037	140	.037	151	.715	49
15000.00	.368	-88	.046	153	.018	158	.744	23
15200.00	.308	-110	.067	141	.071	149	.757	0
15400.00	.229	-132	.093	118	.095	124	.754	-21
15600.00	.140	-155	.116	88	.116	94	.733	-40
15800.00	.068	177	.129	57	.125	63	.695	-58
16000.00	.058	69	.139	30	.137	38	.643	-76
16200.00	.123	10	.154	2	.152	8	.580	-94
16400.00	.178	-22	.167	-26	.156	-18	.521	-112
[illegible]	.195	-50	.139	-56	.136	-15	.440	-132
[illegible]	.171	-59	.214	-90	.216	-91	.388	-148
[illegible]	.152	[illegible]	[illegible]	[illegible]	[illegible]	-121	.257	[illegible]
[illegible]	.174	[illegible]	.232	[illegible]	[illegible]	[illegible]	.271	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.247	-171
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	165

[illegible]

ONR PREAMP

.[illegible]0 VOLTS, .00 MA (MEAS 1) 15MA PER STAGE

FREQ (MHZ)	S11 MAG	S11 ANG	S21 MAG	S21 ANG	S12 MAG	S12 ANG	S22 MAG	S22 ANG
2000.000	.110	31	.012	-101	.006	-119	.700	-10
2200.000	.263	34	.022	-161	.014	-152	.701	-38
2400.000	.387	20	.015	103	.011	38	.698	-66
2600.000	.494	-15	.030	142	.001	-134	.693	-95
2800.000	.564	-54	.206	49	.003	154	.659	-123
3000.000	.565	-92	1.011	-100	.004	130	.699	-142
3200.000	.552	-127	1.956	118	.004	34	.813	175
3400.000	.544	-165	3.410	-18	.002	79	.563	127
3600.000	.290	164	3.999	-172	.003	57	.447	140
3800.000	.697	152	1.170	69	.006	55	.608	113
4000.000	.680	107	1.047	5	.006	24	.648	80
4200.000	.656	70	.897	-76	.004	-7	.606	51
4400.000	.569	25	.737	-156	.003	-10	.556	28
4600.000	.410	110	.304	158	.008	-11	.531	6
4800.000	.716	18	.557	92	.007	-53	.502	-17
5000.000	.670	-20	.547	23	.006	-72	.463	-40
5200.000	.600	-51	.520	-43	.006	-84	.385	-66
5400.000	.502	-80	.474	-103	.007	-96	.245	-84
5600.000	.383	-106	.470	-159	.008	-116	.211	-66
5800.000	.267	-126	.493	138	.009	-133	.286	-79
6000.000	.185	-136	.490	68	.010	-149	.303	-103
6200.000	.152	-141	.487	-9	.013	-169	.285	-127
6400.000	.139	-156	.546	-92	.016	169	.252	-154
6600.000	.109	168	.728	176	.020	142	.217	171
6800.000	.050	65	.907	69	.024	106	.169	107
7000.000	.075	-64	.588	-35	.020	77	.120	13
7200.000	.093	-104	.278	-101	.020	64	.140	-54
7400.000	.110	-126	.182	-134	.023	49	.179	-95
7600.000	.128	-154	.209	-173	.026	29	.219	-128
7800.000	.130	173	.230	117	.031	6	.264	-158
8000.000	.111	141	.238	48	.035	-18	.314	171
8200.000	.077	116	.157	-14	.039	-39	.351	139
8400.000	.044	112	.107	-63	.046	-60	.371	109
8600.000	.039	142	.077	-89	.057	-33	.372	81
8800.000	.057	148	.081	-107	.073	-110	.365	54
9000.000	.075	140	.098	-135	.092	-112	.362	26
9200.000	.096	123	.114	-170	.109	-176	.368	-3
9400.000	.113	93	.124	154	.122	117	.386	-32
9600.000	.117	49	.130	118	.129	110	.418	-61
9800.000	.124	-8	.126	81	.128	72	.461	-89
10000.00	.157	-67	.116	47	.113	34	.511	-115
10200.00	.204	-117	.103	16	.099	-2	.553	-140
10400.00	.245	-131	.031	-3	[illegible]	[illegible]	.631	-165
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]

12400.00	.270	101	.179	102	.156	126	.448	3
12600.00	.352	35	.172	71	.157	74	.393	-17
12800.00	.386	57	.153	46	.153	68	.330	-39
13000.00	.343	23	.160	27	.167	45	.366	-65
13200.00	.246	-16	.190	-0	.195	15	.395	-95
13400.00	.141	-70	.208	-34	.212	-20	.411	-124
13600.00	.102	-163	.209	-71	.212	-58	.454	-151
13800.00	.172	121	.193	-108	.199	-95	.500	-176
14000.00	.252	71	.162	-145	.169	-133	.547	159
14200.00	.314	29	.127	-179	.131	-168	.539	133
14400.00	.357	-6	.089	153	.091	152	.624	104
14600.00	.377	-34	.055	133	.054	113	.661	75
14800.00	.370	-60	.036	140	.036	115	.694	46
15000.00	.337	-83	.044	153	.049	156	.725	20
15200.00	.277	-105	.064	141	.071	150	.744	-3
15400.00	.201	-127	.089	113	.095	125	.750	-23
15600.00	.117	-151	.111	83	.116	95	.734	-41
15800.00	.055	173	.122	56	.124	63	.698	-59
16000.00	.080	64	.132	30	.135	40	.639	-76
16200.00	.149	15	.145	0	.140	9	.559	-94
[illegible]	.211	-14	.149	-23	.134	-17	.477	-113
[illegible]	.236	-43	.166	-54	.134	-45	.371	-134
[illegible]	.212	-75	.191	-87	.203	-81	.258	-159
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.192	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.197	-170
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.225	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	180
[illegible]	.228	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.240	177
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	165

[illegible] INT(DB): [illegible] 0.61, OUT= 0.61

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AMP-21 PREAMP. CHARACTERIZATION
3-STAGE 8-1

00 VOLTS, .00 MA (MEAS 1) V1=4.4 V2=5.7 VG=2.5

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.551	-115	.013	-30	.003	73	.526	-172
2500.000	.427	117	.177	131	.005	-157	.511	75
3000.000	.225	-13	2.530	-137	.001	13	.438	-36
3500.000	.835	-99	.564	-113	.031	157	.877	-96
4000.000	.256	127	4.224	70	.003	-5	.639	116
4500.000	.486	23	4.575	-144	.004	-112	.630	8
5000.000	.510	-98	4.165	15	.008	89	.598	-91
5500.000	.448	108	4.147	-164	.009	-79	.551	-178
6000.000	.348	45	4.351	9	.007	147	.485	94
6500.000	.123	-60	5.060	-174	.007	51	.403	-5
7000.000	.134	-110	5.140	-10	.006	-81	.363	-98
7500.000	.010	-6	5.635	160	.004	-177	.161	-172
8000.000	.219	-125	6.305	-41	.005	96	.084	179
8500.000	.191	108	4.648	107	.006	-17	.147	174
9000.000	.089	-159	3.008	-124	.002	-61	.292	46
9500.000	.162	-48	.271	30	.017	-142	.308	-106
10000.00	.571	140	.141	52	.070	80	.514	140
10500.00	.843	-58	.112	-75	.030	-100	.562	-5
11000.00	.126	-56	.175	160	.007	164	.555	-96
11500.00	.372	-142	.136	47	.020	113	.646	173
12000.00	.444	127	.117	-62	.039	2	.658	82
12500.00	.385	37	.111	-163	.057	-109	.626	-9
13000.00	.263	-40	.144	100	.001	141	.585	-105
13500.00	.339	-93	.192	-14	.120	39	.466	144
14000.00	.373	170	.246	-141	.223	-95	.238	25
14500.00	.335	45	.172	91	.194	128	.375	-75
15000.00	.341	-108	.115	12	.131	39	.493	170
15500.00	.429	115	.223	-71	.251	-51	.374	63
16000.00	.153	-4	.365	157	.408	173	.191	-22
16500.00	.247	-18	.383	25	.445	34	.181	-76
17000.00	.259	-96	.356	-112	.329	-103	.335	-126
17500.00	.316	-164	.235	126	.225	137	.566	145
18000.00	.564	126	.160	6	.152	17	.679	42

REF PLANE EXT(CM): IN= .00, OUT= .00

AUG 9,1980

8-STAGE PREAMP. WAFER #21

.00 VOLTS, .00 MA (MEAS 1)

VD=4V I=60MA/STAGE

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.578	57	.020	142	.003	-118	.515	-1
2200.000	.517	60	.061	125	.005	-135	.494	3
2400.000	.463	60	.184	96	.006	176	.481	9
2600.000	.405	58	.610	65	.005	119	.495	14
2800.000	.353	52	1.807	14	.002	60	.455	17
3000.000	.236	54	4.079	-57	.001	67	.416	31
3200.000	.222	110	5.668	-148	.003	122	.382	51
3400.000	.625	106	3.925	137	.014	115	.516	69
3600.000	.828	79	4.096	177	.012	-69	.477	91
3800.000	.423	50	7.013	100	.004	-35	.546	93
4000.000	.252	98	7.170	52	.003	-17	.627	101
4200.000	.375	123	5.739	1	.003	1	.651	107
4400.000	.466	128	5.726	-38	.004	10	.636	113
4600.000	.524	132	5.909	-72	.005	19	.620	122
4800.000	.561	134	6.026	-99	.007	24	.610	133
5000.000	.573	137	6.150	-124	.010	27	.609	142
5200.000	.548	139	6.143	-148	.014	29	.574	148
5400.000	.478	143	5.660	-170	.019	25	.438	155
5600.000	.370	160	5.220	170	.026	12	.247	-157
5800.000	.440	-177	5.166	139	.025	-12	.567	-123
6000.000	.439	-174	5.228	113	.017	-21	.670	-130
6200.000	.359	-168	5.257	94	.012	-5	.555	-125
6400.000	.265	-159	5.318	77	.010	21	.426	-110
6600.000	.157	-150	5.309	55	.012	47	.302	-87
6800.000	.052	-67	5.113	20	.020	61	.256	-22
7000.000	.184	-36	4.817	-16	.026	18	.639	-22
7200.000	.199	-52	4.683	-31	.011	17	.457	-31
7400.000	.107	-73	4.820	-50	.009	51	.334	-22
7600.000	.037	165	5.041	-83	.010	70	.175	-16
7800.000	.113	117	5.074	-116	.012	72	.079	98
8000.000	.135	127	4.903	-142	.011	71	.202	112
8200.000	.095	133	2.907	180	.010	77	.200	113
8400.000	.097	151	2.725	160	.009	85	.133	125
8600.000	.078	173	2.427	141	.009	88	.081	-161
8800.000	.054	-136	2.204	114	.008	93	.171	-130
9000.000	.082	-88	1.814	91	.007	117	.238	-124
9200.000	.135	-71	1.301	65	.009	146	.270	-126
9400.000	.193	-73	.754	43	.013	159	.273	-131
9600.000	.261	-82	.335	26	.018	171	.273	-133
9800.000	.371	-97	.072	17	.028	-177	.294	-130
10000.00	.550	-116	.093	162	.060	-176	.389	-117
10200.00	.742	-140	.134	137	.102	129	.683	-132
10400.00	.813	-165	.109	147	.045	104	.602	-139
10600.00	.919	146	.051	-164	.078	123	.580	-129
10800.00	.099	151	.198	-173	.016	147	.590	-114
11000.00	.092	-113	.190	176	.022	174	.637	-98
11200.00	.135	-59	.170	177	.027	-164	.653	-81
11400.00	.225	-27	.163	-178	.036	-149	.684	-64
11600.00	.304	-12	.155	-171	.044	-138	.707	-44
11800.00	.331	1	.150	-164	.052	-130	.717	-26
12000.00	.276	20	.139	-152	.056	-121	.723	-6
12200.00	.278	64	.146	-138	.062	-108	.730	12

Good match

Good match

12400.00	.330	87	.158	-127	.073	-97	.704	30
12600.00	.319	108	.173	-116	.087	-86	.670	47
12800.00	.291	135	.189	-109	.098	-80	.642	61
13000.00	.293	163	.200	-101	.104	-72	.613	72
13200.00	.306	-176	.215	-93	.112	-61	.575	80
13400.00	.312	-158	.232	-85	.123	-48	.533	86
13600.00	.314	-144	.258	-80	.150	-36	.467	91
13800.00	.323	-131	.279	-79	.188	-31	.388	97
14000.00	.342	-123	.282	-79	.220	-32	.317	108
14200.00	.361	-119	.255	-80	.227	-35	.287	123
14400.00	.364	-117	.213	-78	.206	-36	.293	129
14600.00	.359	-116	.161	-68	.170	-31	.310	125
14800.00	.331	-118	.122	-46	.132	-13	.346	115
15000.00	.302	-123	.119	-12	.131	18	.388	105
15200.00	.296	-131	.162	13	.185	41	.412	99
15400.00	.291	-145	.227	21	.263	46	.377	97
15600.00	.225	-152	.278	23	.334	47	.292	104
15800.00	.140	-133	.321	28	.389	43	.212	119
16000.00	.117	-97	.371	26	.409	39	.149	139
16200.00	.124	-55	.398	23	.434	37	.107	166
16400.00	.163	-25	.404	21	.438	33	.064	-180
16600.00	.192	-9	.411	19	.441	28	.030	57
16800.00	.159	17	.402	15	.395	19	.174	38
17000.00	.184	65	.345	8	.284	17	.301	36
17200.00	.258	88	.255	10	.222	26	.427	41
17400.00	.259	107	.230	28	.206	45	.520	45
17600.00	.304	139	.238	31	.224	48	.581	54
17800.00	.429	160	.214	31	.202	45	.645	65
18000.00	.571	171	.163	35	.147	48	.670	78

REF PLANE EXT(CM): IN=10.92, OUT=10.92

 AUG 9,1980

8-STAGE PREAMP. WAFER #21

.00 VOLTS, .00 MA (MEAS 1) VD=3 ID=55MA/STAGE

FREQ (MHZ)	GA MAX DB	GU MAX DB	S21 DB	S12 DB	K MAG	U MAG
2000.000	-34.43	-34.43	-37.45	-50.32	999.90	.00
2200.000	-26.54	-26.54	-29.01	-45.40	999.90	.00
2400.000	-17.84	-17.84	-19.94	-43.44	455.46	.00
2600.000	-9.03	-9.03	-10.86	-46.22	234.56	.00
2800.000	-1.28	-1.28	-2.73	-51.00	174.07	.00
3000.000	4.09	4.09	3.07	-58.08	222.36	.00
3200.000	7.40	7.41	6.68	-50.27	64.03	.00
3400.000	8.18	8.04	5.13	-33.76	6.73	.02
3600.000	11.22	10.71	3.61	-38.32	4.77	.05
3800.000	12.43	12.41	9.75	-45.95	17.41	.01
4000.000	12.36	12.38	10.27	-51.05	33.79	.00
4200.000	11.53	11.56	9.17	-50.72	34.69	.00
4400.000	12.18	12.19	9.61	-49.34	26.83	.00
4600.000	12.67	12.63	9.92	-47.46	20.04	.01
4800.000	12.90	12.82	10.05	-45.34	15.11	.01
5000.000	12.74	12.67	10.02	-43.27	12.30	.01
5200.000	12.09	12.07	9.78	-40.67	10.31	.01
5400.000	10.57	10.62	8.90	-38.34	10.12	.01
5600.000	9.62	9.68	8.10	-36.11	8.88	.01
5800.000	9.91	9.84	7.53	-35.63	7.37	.02
6000.000	9.48	9.38	7.23	-37.45	9.70	.01
6200.000	8.40	8.36	6.85	-39.26	14.61	.00
6400.000	7.60	7.59	6.55	-39.45	17.34	.00
6600.000	6.87	6.88	6.00	-37.88	16.08	.00
6800.000	6.32	6.33	5.03	-34.89	11.58	.00
7000.000	5.03	5.01	3.65	-35.86	14.85	.00
7200.000	3.98	3.97	3.20	-39.41	26.99	.00
7400.000	3.38	3.38	2.91	-38.64	27.44	.00
7600.000	3.12	3.12	2.66	-38.08	26.55	.00
7800.000	2.43	2.44	1.92	-39.13	32.24	.00
8000.000	1.14	1.14	.68	-40.22	42.67	.00
8200.000	-3.48	-3.47	-3.89	-40.23	73.08	.00
8400.000	-4.88	-4.88	-5.27	-39.31	77.44	.00
8600.000	-6.30	-6.30	-6.72	-37.97	77.91	.00
8800.000	-8.31	-8.31	-8.79	-37.14	88.55	.00
9000.000	-10.57	-10.57	-11.13	-36.49	105.61	.00
9200.000	-13.40	-13.40	-14.02	-35.61	131.41	.00
9400.000	-16.93	-16.93	-17.64	-34.38	169.42	.00
9600.000	-22.32	-22.32	-23.22	-32.79	256.79	.00
9800.000	-31.97	-31.97	-33.24	-30.51	575.01	.00
10000.00	-18.48	-18.47	-20.67	-23.80	50.47	.00
10200.00	-13.04	-12.86	-18.33	-19.04	10.94	.02
10400.00	-17.62	-17.58	-22.43	-24.76	37.80	.01
10600.00	-26.20	-26.21	-29.03	-19.61	70.40	.00
10800.00	-14.30	-14.30	-16.24	-34.01	104.15	.00
11000.00	-14.40	-14.40	-16.72	-29.72	61.50	.00
11200.00	-14.60	-14.59	-17.11	-27.60	48.21	.00
11400.00	-14.07	-14.06	-17.03	-25.68	34.57	.00
11600.00	-13.61	-13.62	-16.92	-24.32	26.95	.00
11800.00	-13.87	-13.89	-17.38	-23.24	23.94	.01
12000.00	-14.59	-14.63	-18.09	-22.84	24.89	.01
12200.00	-14.94	-14.98	-18.37	-22.11	24.00	.00

12400.00	.329	82	.130	-135	.085	-122	.679	30
12600.00	.345	108	.140	-123	.091	-112	.654	47
12800.00	.345	128	.149	-114	.097	-102	.632	61
13000.00	.313	149	.160	-102	.102	-90	.606	72
13200.00	.293	173	.182	-92	.114	-76	.571	80
13400.00	.295	-165	.211	-85	.132	-65	.532	87
13600.00	.317	-150	.234	-82	.158	-57	.478	94
13800.00	.331	-139	.251	-81	.182	-54	.429	101
14000.00	.346	-132	.251	-81	.198	-52	.389	109
14200.00	.356	-127	.234	-81	.201	-52	.357	115
14400.00	.356	-124	.204	-79	.186	-51	.338	118
14600.00	.349	-122	.165	-75	.157	-46	.337	115
14800.00	.317	-123	.114	-62	.121	-31	.367	107
15000.00	.285	-127	.087	-25	.109	2	.407	100
15200.00	.277	-135	.124	13	.158	30	.424	96
15400.00	.260	-151	.200	20	.234	34	.386	97
15600.00	.176	-160	.244	16	.293	33	.300	105
15800.00	.063	-110	.244	20	.340	30	.226	122
16000.00	.137	-57	.291	24	.354	28	.172	141
16200.00	.191	-41	.322	23	.381	26	.136	160
16400.00	.215	-25	.332	19	.387	23	.081	166
16600.00	.232	-10	.334	18	.394	18	.046	72
16800.00	.200	15	.327	15	.355	9	.170	37
17000.00	.205	54	.286	11	.254	7	.293	40
17200.00	.245	82	.228	14	.199	19	.432	43
17400.00	.265	108	.217	27	.202	35	.522	46
17600.00	.316	135	.222	30	.207	36	.588	55
17800.00	.420	158	.200	26	.180	34	.651	66
18000.00	.563	171	.146	31	.136	42	.680	79

REF PLANE EXT(CM): IN=10.92, OUT=10.92

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8-STAGE PREAMP. WAFER #21

.00 VOLTS, .00 MA (MEAS 1) VD=6 ID=53MA/STAGE

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.571	58	.011	144	.003	-122	.512	-1
2200.000	.508	61	.028	125	.005	-140	.494	3
2400.000	.452	61	.078	88	.006	171	.483	8
2600.000	.395	59	.233	54	.004	114	.488	13
2800.000	.339	55	.709	5	.002	57	.462	18
3000.000	.236	57	1.965	-59	.001	68	.430	29
3200.000	.212	114	3.429	-149	.003	130	.382	46
3400.000	.656	111	2.112	113	.017	111	.391	68
3600.000	.798	75	2.266	180	.013	-44	.634	83
3800.000	.412	49	4.143	94	.005	-50	.599	87
4000.000	.245	98	3.890	52	.003	-29	.645	96
4200.000	.354	122	3.866	17	.003	-0	.658	103
4400.000	.434	129	4.029	-18	.004	10	.641	111
4600.000	.488	133	4.112	-49	.005	19	.622	120
4800.000	.524	137	4.144	-78	.007	27	.606	131
5000.000	.543	140	4.087	-106	.010	33	.591	142
5200.000	.536	143	3.985	-131	.015	38	.568	153
5400.000	.490	146	3.759	-153	.024	32	.498	163
5600.000	.351	157	3.557	-168	.031	6	.404	-166
5800.000	.392	-173	4.211	172	.023	-15	.540	-144
6000.000	.405	-167	4.408	145	.016	-9	.579	-135
6200.000	.346	-159	4.428	121	.013	7	.542	-125
6400.000	.277	-147	4.429	100	.012	29	.467	-112
6600.000	.205	-131	4.478	80	.013	55	.376	-94
6800.000	.121	-112	4.789	59	.019	77	.270	-67
7000.000	.141	-28	5.264	29	.039	63	.411	-15
7200.000	.253	-56	4.310	4	.024	24	.434	-39
7400.000	.174	-81	4.727	-9	.015	35	.273	-35
7600.000	.093	-120	5.484	-35	.013	52	.134	-24
7800.000	.109	-159	5.882	-65	.014	54	.046	77
8000.000	.173	-175	6.079	-95	.009	46	.093	102
8200.000	.248	174	5.298	-134	.007	63	.080	134
8400.000	.263	169	4.893	-165	.006	76	.065	-179
8600.000	.241	168	4.383	165	.005	83	.101	-110
8800.000	.191	161	3.992	131	.004	71	.239	-89
9000.000	.071	130	3.233	88	.003	-49	.386	-96
9200.000	.095	-41	1.823	43	.010	-128	.429	-111
9400.000	.192	-66	.740	11	.016	-150	.382	-119
9600.000	.277	-79	.220	-14	.023	-156	.351	-121
9800.000	.398	-95	.028	-137	.036	-159	.363	-119
10000.00	.573	-115	.112	163	.067	-171	.466	-112
10200.00	.744	-141	.122	140	.095	129	.709	-130
10400.00	.802	-169	.110	159	.032	101	.597	-135
10600.00	.702	124	.073	152	.069	120	.576	-126
10800.00	.075	161	.167	-169	.012	164	.582	-111
11000.00	.080	-76	.170	179	.017	-161	.635	-95
11200.00	.184	-38	.159	179	.025	-142	.654	-79
11400.00	.289	-22	.150	-179	.032	-131	.688	-62
11600.00	.361	-7	.142	-175	.040	-120	.712	-43
11800.00	.409	8	.125	-171	.047	-110	.722	-25
12000.00	.412	23	.106	-159	.054	-97	.728	-6
12200.00	.360	45	.098	-140	.068	-85	.736	12

12400.00	.358	75	.107	-121	.086	-77	.704	29
12600.00	.350	98	.121	-106	.104	-74	.663	45
12800.00	.307	118	.139	-97	.108	-71	.635	59
13000.00	.250	146	.155	-87	.115	-62	.606	70
13200.00	.245	179	.173	-80	.120	-54	.570	77
13400.00	.276	-157	.191	-72	.125	-39	.530	83
13600.00	.311	-144	.209	-66	.156	-23	.462	86
13800.00	.326	-133	.232	-64	.209	-18	.360	89
14000.00	.343	-125	.241	-64	.256	-22	.258	105
14200.00	.368	-119	.222	-65	.262	-28	.245	130
14400.00	.382	-116	.186	-62	.230	-30	.281	138
14600.00	.390	-115	.147	-52	.185	-25	.309	130
14800.00	.373	-116	.114	-29	.146	-5	.336	116
15000.00	.347	-122	.117	3	.160	24	.366	103
15200.00	.337	-131	.159	27	.220	40	.382	97
15400.00	.322	-145	.233	34	.291	42	.362	94
15600.00	.244	-156	.278	31	.331	40	.286	91
15800.00	.112	-138	.298	34	.343	43	.147	81
16000.00	.113	-78	.349	37	.383	45	.022	165
16200.00	.144	-46	.385	33	.421	43	.073	-125
16400.00	.170	-19	.392	28	.439	39	.086	-110
16600.00	.221	4	.381	26	.448	34	.051	-37
16800.00	.232	24	.367	23	.402	26	.179	20
17000.00	.237	54	.321	19	.321	23	.290	27
17200.00	.287	79	.254	19	.247	25	.412	37
17400.00	.267	97	.209	35	.212	44	.516	44
17600.00	.293	136	.233	43	.240	49	.593	52
17800.00	.425	159	.223	36	.219	42	.653	63
18000.00	.568	170	.154	36	.146	39	.676	76

REF PLANE EXT(CM): IN=10.92, OUT=10.92

8-STAGE PREAMP. WAFER #21

.00 VOLTS, .00 MA (MEAS 1) VD=5 ID=54MA/STAGE

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.573	57	.012	144	.003	-119	.505	-1
2200.000	.512	61	.032	130	.005	-135	.485	2
2400.000	.458	61	.089	98	.006	176	.473	8
2600.000	.401	58	.275	68	.005	118	.479	13
2800.000	.348	54	.857	21	.003	59	.452	18
3000.000	.240	55	2.417	-42	.001	61	.418	29
3200.000	.217	114	4.181	-135	.003	129	.368	46
3400.000	.653	109	2.435	131	.017	109	.395	72
3600.000	.780	77	3.089	-164	.014	-45	.625	81
3800.000	.420	50	5.270	109	.005	-51	.585	86
4000.000	.250	98	5.090	65	.003	-30	.626	96
4200.000	.359	123	4.799	27	.003	0	.643	103
4400.000	.443	130	4.917	-8	.004	11	.631	111
4600.000	.504	135	5.027	-40	.005	19	.613	121
4800.000	.550	139	5.094	-69	.007	26	.599	131
5000.000	.576	141	5.058	-96	.010	32	.587	142
5200.000	.571	143	4.923	-122	.014	37	.566	152
5400.000	.497	144	4.501	-144	.022	31	.492	162
5600.000	.358	163	4.355	-157	.029	9	.375	-168
5800.000	.428	-173	4.846	180	.023	-12	.516	-141
6000.000	.437	-167	5.083	152	.016	-8	.577	-133
6200.000	.381	-159	5.184	129	.013	7	.545	-124
6400.000	.310	-149	5.200	107	.011	29	.465	-111
6600.000	.233	-139	5.200	89	.012	55	.366	-94
6800.000	.115	-131	5.515	69	.018	78	.249	-65
7000.000	.185	-44	5.720	32	.038	65	.422	-7
7200.000	.165	-61	5.419	14	.024	23	.462	-36
7400.000	.115	-56	5.701	-9	.015	35	.286	-32
7600.000	.082	-64	5.908	-33	.013	52	.138	-20
7800.000	.108	-123	6.449	-59	.013	54	.059	82
8000.000	.197	-173	6.767	-96	.009	47	.117	102
8200.000	.190	164	4.557	-142	.007	63	.104	126
8400.000	.208	165	4.342	-168	.006	77	.079	161
8600.000	.192	169	3.882	163	.005	89	.086	-127
8800.000	.150	167	3.544	132	.005	90	.207	-98
9000.000	.059	154	2.922	97	.001	104	.330	-103
9200.000	.071	-38	1.923	57	.007	-148	.372	-113
9400.000	.170	-61	.926	26	.013	-160	.349	-121
9600.000	.255	-78	.324	2	.021	-162	.328	-124
9800.000	.377	-95	.032	-49	.033	-163	.344	-122
10000.00	.562	-116	.115	166	.066	-174	.451	-114
10200.00	.741	-141	.130	140	.094	126	.702	-132
10400.00	.821	-165	.111	158	.035	100	.596	-137
10600.00	.890	139	.071	163	.067	116	.575	-127
10800.00	.120	159	.188	-167	.013	158	.581	-112
11000.00	.084	-116	.192	-179	.017	-168	.631	-97
11200.00	.146	-53	.178	179	.024	-146	.646	-80
11400.00	.239	-29	.172	-180	.032	-135	.681	-63
11600.00	.307	-11	.159	-177	.039	-123	.705	-44
11800.00	.356	7	.142	-173	.046	-112	.716	-26
12000.00	.364	23	.117	-162	.054	-100	.721	-7
12200.00	.317	47	.107	-143	.066	-88	.729	11

12400.00	.323	78	.120	-124	.084	-80	.701	28
12600.00	.310	103	.135	-111	.102	-75	.664	44
12800.00	.277	128	.152	-102	.108	-73	.633	58
13000.00	.256	158	.170	-92	.113	-65	.603	69
13200.00	.274	-174	.190	-85	.117	-56	.568	77
13400.00	.304	-155	.207	-78	.124	-40	.527	82
13600.00	.324	-142	.229	-73	.155	-26	.460	85
13800.00	.333	-131	.250	-72	.204	-21	.362	90
14000.30	.346	-124	.255	-73	.247	-24	.266	104
14200.00	.359	-118	.228	-73	.252	-30	.249	127
14400.00	.370	-115	.191	-70	.220	-32	.279	134
14600.00	.376	-114	.145	-60	.177	-26	.305	126
14800.00	.354	-115	.110	-36	.139	-6	.334	112
15000.00	.326	-121	.117	-1	.155	24	.369	100
15200.00	.320	-130	.161	20	.215	39	.387	95
15400.00	.308	-145	.219	26	.284	41	.365	93
15600.00	.224	-153	.257	28	.325	40	.292	91
15800.00	.137	-122	.305	35	.342	41	.161	84
16000.00	.137	-92	.364	33	.387	43	.034	133
16200.00	.126	-56	.395	29	.421	41	.057	-132
16400.00	.162	-18	.395	25	.432	36	.072	-107
16600.00	.221	-0	.400	24	.439	31	.055	-29
16800.00	.212	18	.396	20	.391	22	.184	20
17000.00	.207	55	.351	12	.306	20	.296	27
17200.00	.263	82	.264	10	.235	23	.420	36
17400.00	.251	102	.223	27	.206	42	.520	43
17600.00	.290	139	.234	32	.231	46	.592	51
17800.00	.422	161	.210	29	.207	39	.650	63
18000.00	.580	171	.150	31	.137	38	.673	76

REF PLANE EXT(CM): IN=10.92, OUT=10.92

AUG. 28, 1980

OHR-21 PREAMP. CHARACTERIZATION
8 STAGE UNIT 2

.00 VOLTS, .00 MA (MEAS 1) V1=4.4 V2=5.9 VG=2.4

I_D = 50mA/st for 1+2

I_D = 75mA/s for 3 to 8

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.523	-116	.012	-49	.002	78	.441	-168
2500.000	.422	115	.143	83	.004	-136	.403	78
3000.000	.288	-21	1.766	-158	.000	-145	.338	-36
3500.000	.344	-38	4.824	-129	.006	-38	.140	-138
4000.000	.394	117	2.887	71	.004	26	.648	124
4500.000	.509	28	3.478	-148	.002	-25	.545	14
5000.000	.575	-89	3.466	3	.002	-124	.481	-81
5500.000	.563	158	3.410	178	.002	132	.445	-174
6000.000	.452	56	3.445	-13	.001	18	.391	95
6500.000	.355	-28	3.833	165	.001	-43	.319	5
7000.000	.330	-108	3.655	-27	.002	-105	.254	-81
7500.000	.247	163	4.134	146	.003	161	.193	-163
8000.000	.097	93	4.853	-42	.005	47	.194	115
8500.000	.181	93	4.137	111	.004	-35	.305	89
9000.000	.034	44	2.330	-132	.003	86	.443	-19
9500.000	.328	-3	.273	48	.008	-145	.448	-136
10000.00	.391	-109	.026	-32	.012	123	.433	116
10500.00	.351	111	.049	-10	.032	22	.464	16
11000.00	.594	-117	.101	-166	.035	-163	.721	-70
11500.00	.233	154	.245	91	.012	77	.569	-162
12000.00	.340	100	.121	-54	.025	33	.676	93
12500.00	.411	23	.100	-160	.032	-76	.643	-3
13000.00	.432	-40	.103	94	.038	-160	.591	-105
13500.00	.462	-112	.117	-18	.111	91	.512	154
14000.00	.503	172	.111	-142	.138	-61	.573	61
14500.00	.486	87	.075	104	.105	180	.611	-46
15000.00	.329	-1	.046	22	.098	84	.568	-158
15500.00	.140	-91	.055	-47	.112	-16	.531	86
16000.00	.202	47	.110	-135	.175	-110	.481	-26
16500.00	.268	-62	.200	101	.304	128	.340	-142
17000.00	.239	-125	.236	-50	.402	-24	.231	134
17500.00	.283	167	.209	-156	.374	-149	.309	-0
18000.00	.306	105	.262	46	.406	47	.289	104

REF PLANE EXT(CM): IN= .00, OUT= .00

PAGE 1: 1 AUG. 25,1980

ONR-28 PREAMP. CHARACTERIZATION
8-STAGE

.00 VOLTS, .00 MA (MEAS 1) V1=4 V2=5.1 I=40MA/S

FREQ	S11		S21		S12		S22	
(MHZ)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2000.000	.544	-119	.024	4	.000	-2	.542	-169
2500.000	.079	84	.852	126	.008	-69	.562	78
3000.000	.235	62	4.346	-155	.003	84	.445	-35
3500.000	.287	-49	8.217	-81	.001	-17	.433	-166
4000.000	.439	132	7.217	57	.003	25	.693	132
4500.000	.439	-21	9.527	155	.001	-158	.504	-4
5000.000	.456	-89	4.943	-25	.017	-133	.521	-15
5500.000	.122	111	7.472	120	.003	136	.465	-159
6000.000	.115	131	6.844	-81	.004	55	.460	102
6500.000	.166	23	5.497	84	.005	-29	.430	2
7000.000	.128	-39	4.621	-108	.007	-118	.320	-93
7500.000	.252	-109	3.924	53	.011	147	.230	-170
8000.000	.281	143	2.525	-151	.015	51	.152	111
8500.000	.200	60	1.153	9	.027	-60	.159	88
9000.000	.044	19	.410	-163	.018	-163	.279	-6
9500.000	.214	-51	.121	52	.035	93	.289	-122
10000.00	.253	176	.061	-64	.046	-34	.301	112
10500.00	.265	20	.037	159	.038	-172	.305	-6
11000.00	.137	-26	.107	-48	.060	21	.214	-78
11500.00	.441	-151	.100	54	.011	99	.649	-154
12000.00	.570	110	.061	-47	.027	8	.685	102
12500.00	.576	15	.073	-148	.046	-110	.687	10
13000.00	.476	-77	.107	99	.078	128	.642	-86
13500.00	.366	-169	.140	-23	.110	1	.563	169
14000.00	.263	73	.170	-143	.149	-119	.505	49
14500.00	.229	-79	.226	85	.218	103	.445	-66
15000.00	.252	109	.121	-48	.124	-38	.520	-163
15500.00	.149	3	.134	-134	.124	-133	.618	89
16000.00	.116	-52	.132	98	.121	96	.656	-6
16500.00	.155	-27	.074	-10	.035	-30	.667	-97
17000.00	.251	-150	.093	-98	.073	-50	.609	164
17500.00	.109	83	.088	117	.092	155	.477	49
18000.00	.255	-172	.024	-126	.006	39	.450	-130

REF PLANE EXT(CM): IN= .00, OUT= .00

APPENDIX D
STAGE AMPLIFIER TEST DATA

The gain of each amplifier was determined by measuring the transmission coefficient (S_{21}) in a 50 system. The input power level was -30 dBm. The measured gain as a function of frequency is shown in Figures D1-D6. In general, the gain is highest at 2 GHz and decreases to 0 dB at 9 GHz. The maximum gain measured was 35 dB, however, the data (Figure D-2) indicate that the measurement system saturated at that level. The bias conditions for each measurement are listed in Table D-1.

Noise figure data are given in Table D-2. The noise figure and associated gain were measured at 6 GHz. The amplifiers have a noise figure of 7 dB with 20 dB of associated gain. The corresponding bias conditions for minimum noise are also given in Table D-2. Note that the gain spectrum for ONR-38 1-5 as biased for minimum noise figure is included as Figure D-4.

Table D-1. Bias Conditions for ONR Amplifiers During Gain Measurements

FIGURE NUMBER	1	2	3	4	5	6
AMPLIFIER	ONR-38 1-7	ONR-38 1-6	ONR-38 1-5	ONR-38 1-5	ONR-37 2-1	ONR-38 43-03
BIAS:						
Vd1	3	3	3	3	3	3
Id1	65	65	70	40	75	95
Vd2	3	3	4	3	3.57	3
Id2	170	180	140	130	300	210
Vg1	-1.0	-1.0	-1.0	-1.8	-2.0	-0.2
Vg2	-1.0	-1.0	-1.0	-1.8	-2.0	-0.5
Vg3	-2.2	-1.7	-2.3	-2.3	-2.0	-1.2
Vg4	-1.7	-1.9	-1.8	-1.7	-2.0	-1.2
Vg5	-1.0	-1.0	-1.8	-1.8	-2.0	-1.2
Vg6	-1.2	-1.0	-1.6	-1.6	0.0*	-0.2
Vg7	-1.0	-1.0	-1.2	-1.2	-2.0	-0.7
Vg8	-1.0	-1.0	-1.7	-1.6	-2.0	-1.2

*Gate is shorted. Do not apply gate bias.

Table D-2. Noise Figure and Associated Gain For ONR Amplifiers Measured at 6 GHz

AMPLIFIER	ONR-38 1-6	ONR-38 1-5	ONR-38 1-7
NOISE FIGURE	6.9	6.7	7.1
ASSOCIATED GAIN	20.6	20.6	19.6
BIAS:			
Vd1	3	3	3
Id1	40	40	55
Vd2	3	3	4
Id2	165	130	150
Vg1	-1.6	-1.8	-1.2
Vg2	-1.4	-1.8	-1.5
Vg3	-1.8	-2.3	-2.5
Vg4	-2.0	-1.7	-1.7
Vg5	-1.0	-1.8	-1.7
Vg6	-1.0	-1.6	-1.1
Vg7	-1.0	-1.2	-1.0
Vg8	-1.0	-1.6	-1.0

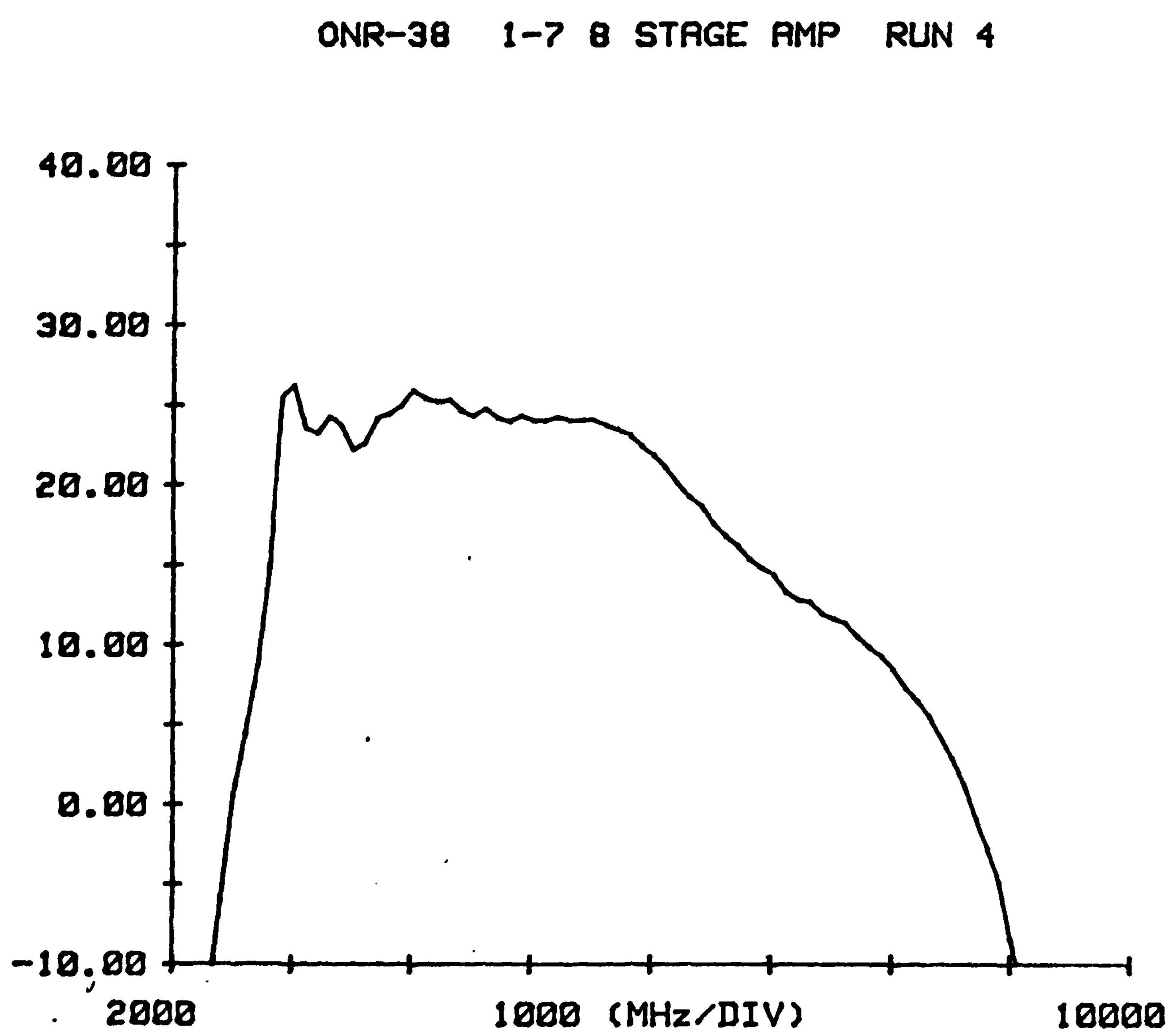
ONR-38 1-7 8 STAGE AMP RUN 4
40.00
30.00
20.00
10.00
0.00
-10.00
S21 (dB)
2000
1000 (MHz/DIV)
10000

Figure D-1

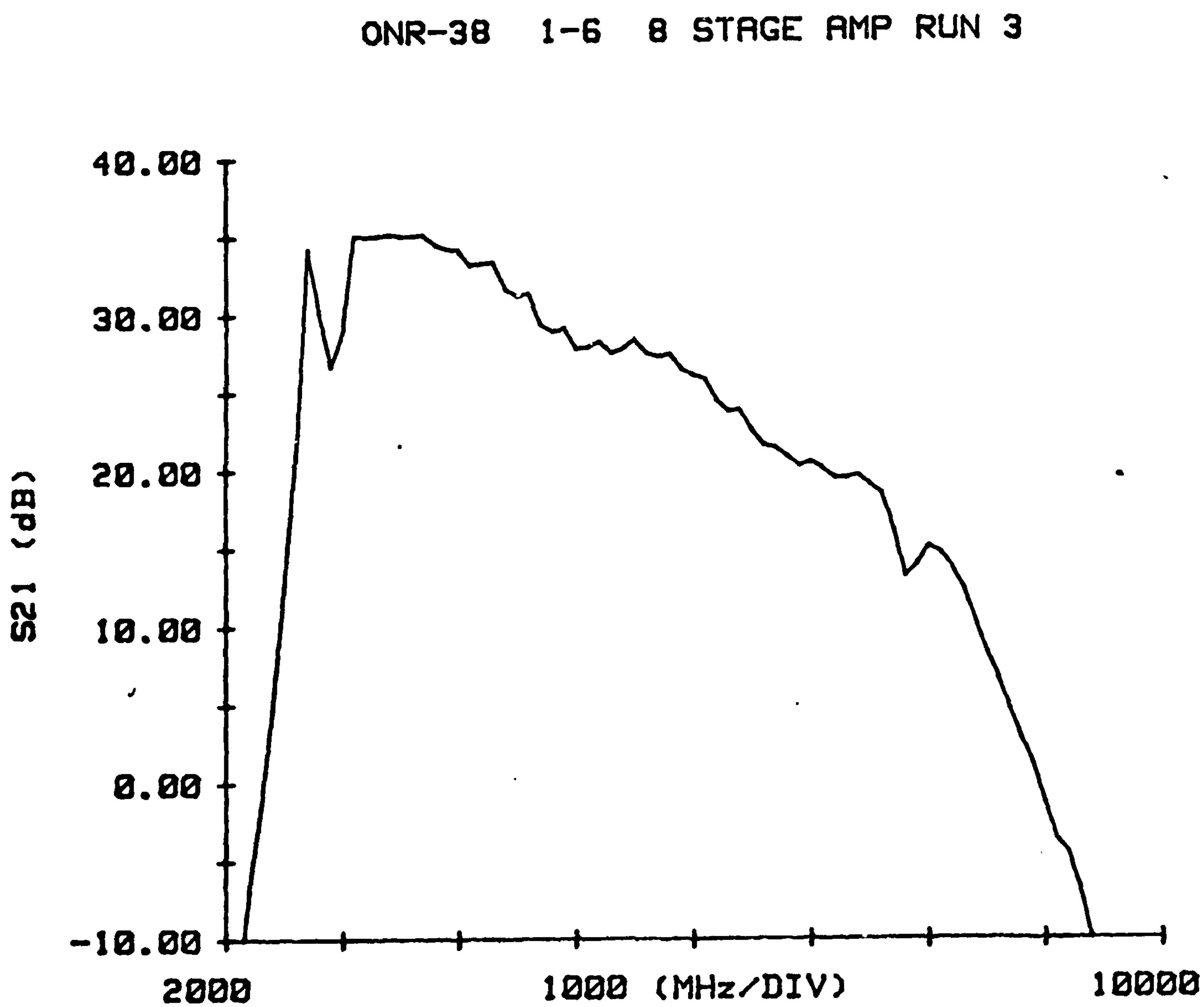
ONR-38 1-6 8 STAGE AMP RUN 3
40.00
30.00
20.00
10.00
0.00
-10.00
S21 (dB)
2000
1000 (MHz/DIV)
10000

Figure D-2

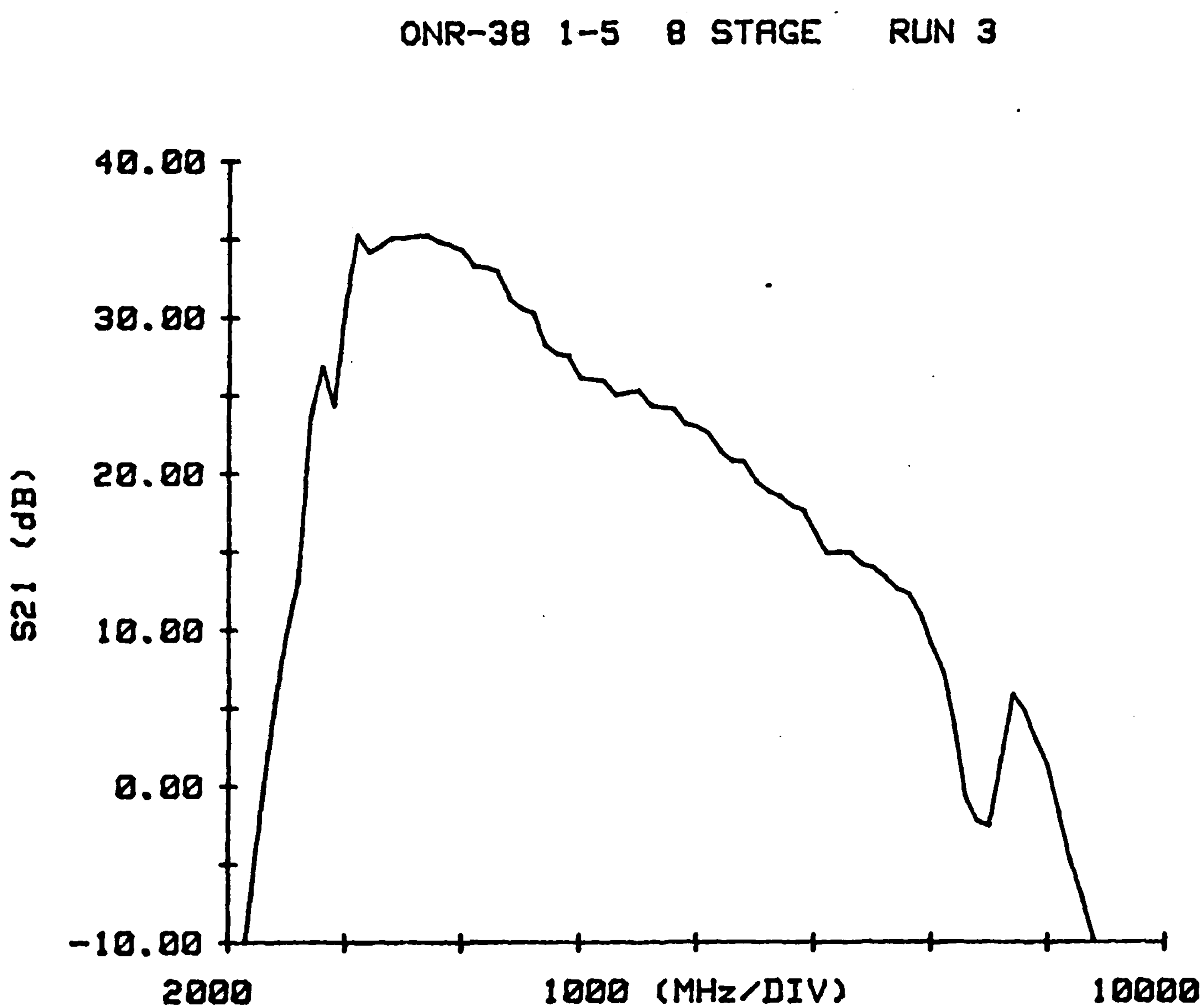
ONR-38 1-5 8 STAGE RUN 3
40.00
30.00
20.00
10.00
0.00
-10.00
S21 (dB)
2000
1000 (MHz/DIV)
10000

Figure D-3

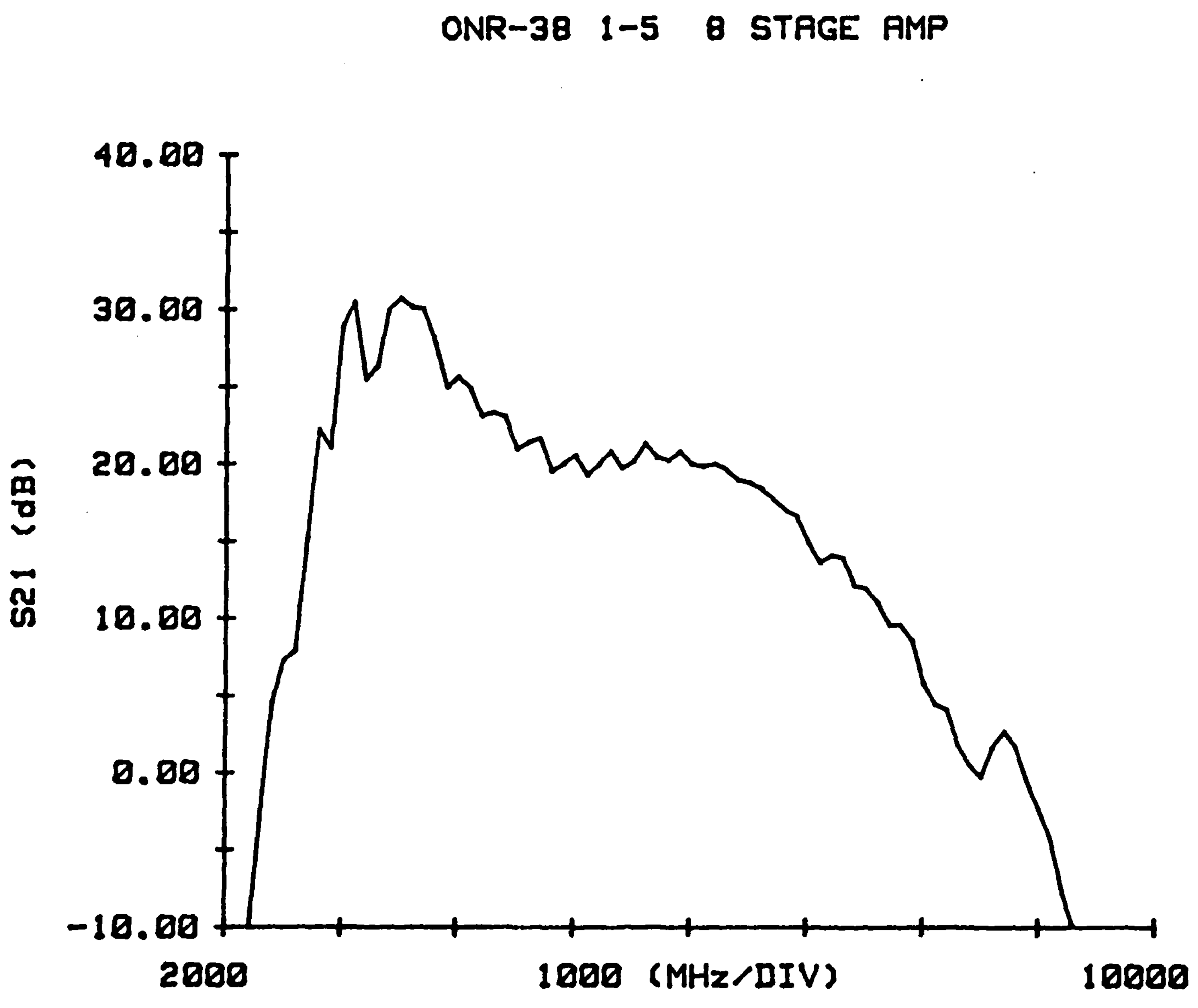
ONR-38 1-5 8 STAGE AMP
40.00
30.00
20.00
10.00
0.00
-10.00
S21 (dB)
2000
1000 (MHz/DIV)
10000

Figure D-4

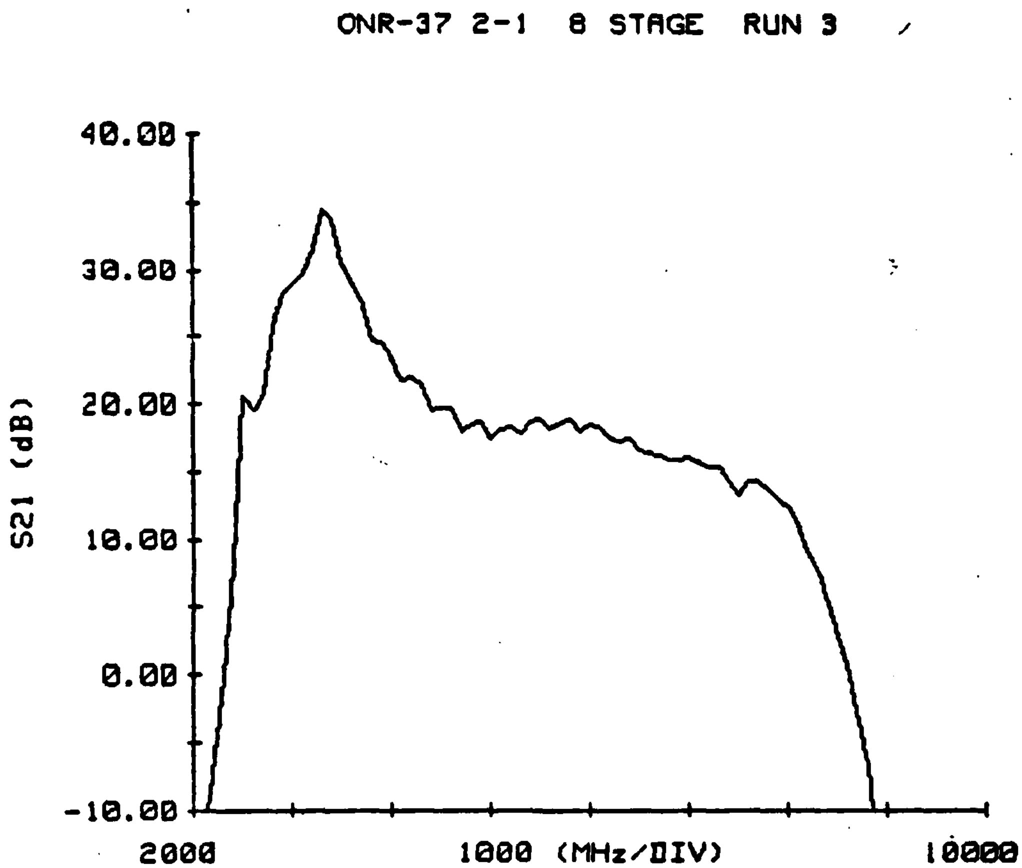
ONR-37 2-1 8 STAGE RUN 3
40.00
30.00
20.00
10.00
0.00
-10.00
S21 (dB)
2000
1000 (MHz/DIV)
10000

Figure D-5

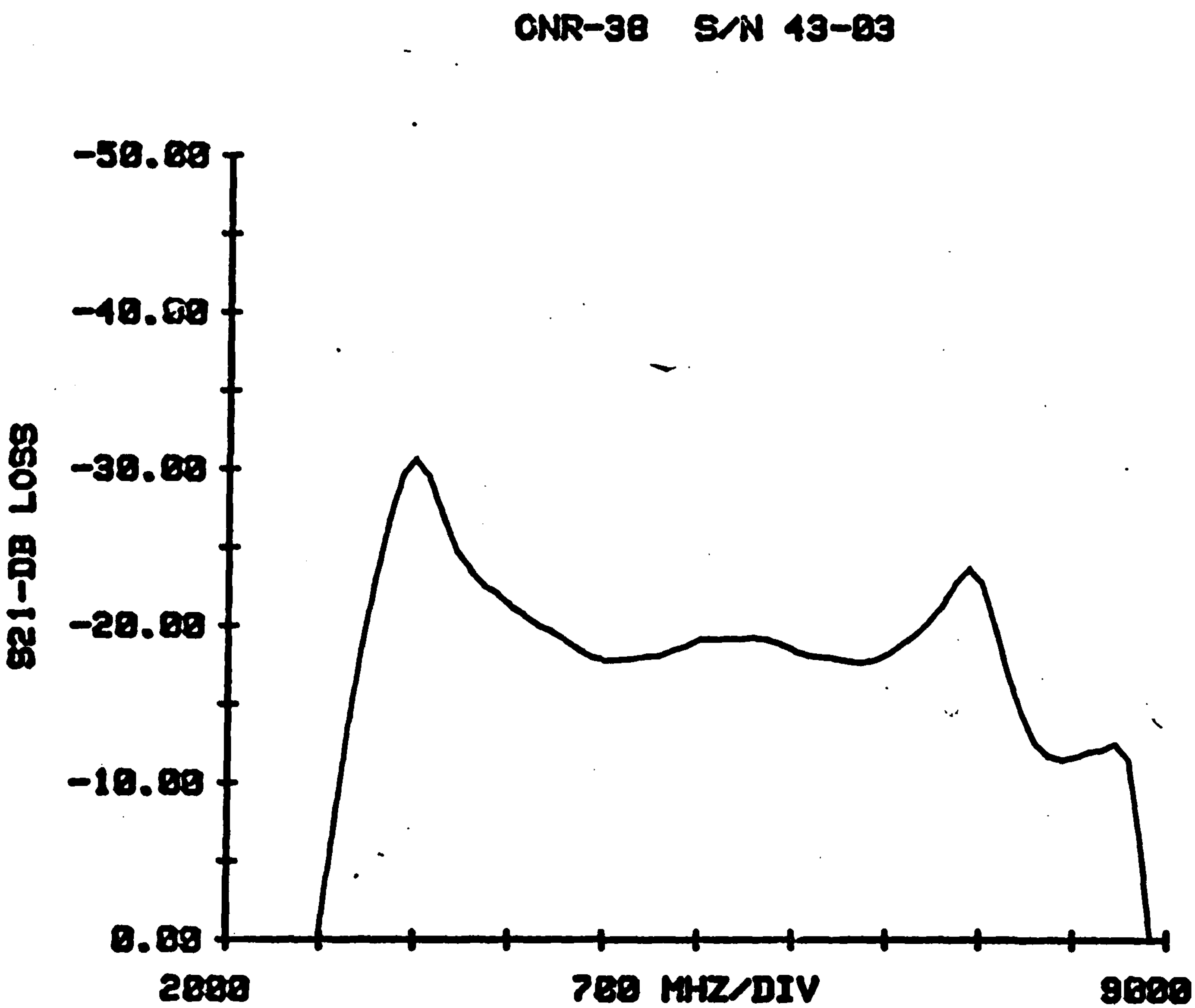
CNR-38 S/N 43-03
-50.00
-40.00
-30.00
-20.00
-10.00
0.00
S21-DB LOSS
2000
700 MHZ/DIV
9000

Figure D-6

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